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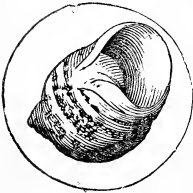
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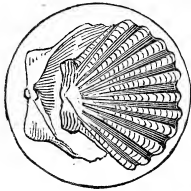
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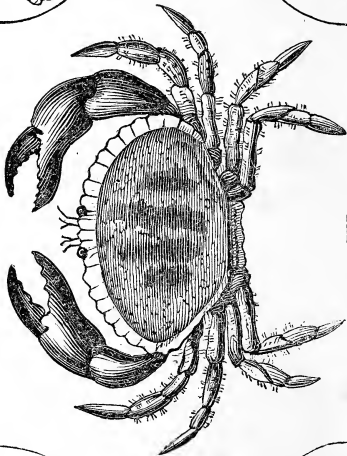
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Class Mollusca



Class Conchifera



Class Crustacea.

THE

FIVE CLASSES OF INVERTEBRAL ANIMALS

Class Cirrhipeda.



Class Annulata.



DESCRIBED IN THIS VOLUME.

THE
BOOK OF SHELLS;

CONTAINING

THE CLASSES MOLLUSCA, CONCHIFERA,
CIRRHIPEDA, ANNULATA, AND
CRUSTACEA.

PUBLISHED UNDER THE DIRECTION OF
THE COMMITTEE OF GENERAL LITERATURE AND EDUCATION,
APPOINTED BY THE SOCIETY FOR PROMOTING
CHRISTIAN KNOWLEDGE.

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M.DCCC.XXXVI.

TO THE READER.

IN describing that portion of the system of Natural History which embraces the VERTEBRAL ANIMALS,—namely, the Mammalia, the Birds, the Reptiles, and the Fishes,—the arrangement of the BARON CUVIER was adopted. In the present little volume, as well as in two others that are to follow, and which, together, will comprise the INVERTEBRAL ANIMALS, the method of M. LAMARCK will be adhered to. It is true, that, since the works of that naturalist were published, many deviations from certain parts of his system have taken place, some of which have received the sanction of the highest names; but still, *as a whole*, Lamarck's System remains unrivalled, and the young naturalist can readily add to the information it contains, by reference to the works of more recent authors, in case he has sufficient inclination and industry to follow out the subject.

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THE BOOK OF SHELLS.

INTRODUCTORY CHAPTER.

IN reviewing the first DIVISION of the animal kingdom, namely, the vertebral animals, we cannot fail to have been delighted with the wonderful and appropriate faculties bestowed upon each individual ; but beautiful and well adapted to the use of their possessors as these faculties may have appeared, our pleasure must be still greater in tracing the powers with which those creatures are endowed, which constitute what we have been accustomed to call the lower orders of animated nature.

When contemplating the graceful form of the horse, or the stag, or the beautiful plumage of the feathered tribes, or when we notice the terrific appearance of the crocodile, or the elaborate finish and metallic lustre of the scales of fishes, we are led to expect that equal care has been bestowed upon the rest of the organization of the different individuals, and that equal attention has been paid to the various instincts and powers that are necessary to their preservation ; but when we observe a snail or a worm, and compare their more simple appearance, and the perfect absence of what we have been accustomed to consider the organs of motion, namely, feet and hands, we are apt to look on them as having been created for some very subordinate purpose, and, therefore, less carefully formed than the vertebral animals. How much greater then must be our delight, when we find them possessed of every power necessary to their state of existence, as beautifully developed and as care-

fully adapted to their necessities, as the highest instincts of other classes are to their possessors. Nor is their organization to be considered less perfect, because we are unable to trace it in all its ramifications; the minute branches of the nerves of the human body are not only invisible to the naked eye, but even to the most acute observer when assisted by the magnifying power of the microscope, but we are certain that they do exist, from the pain we feel when they are injured. Until lately, the *infusoria*, those microscopic animals that are found in infusions of vegetable substances in water, were supposed to be possessed of neither nerves nor stomach, and to be fed by absorption; but the ingenious experiments of a learned foreigner have proved, that instead of being without a stomach, they are provided with as many as five or six: it is true, that the nerves have not yet been detected, but we have a right to infer their existence from their effects, so that these minute creatures, which we have been accustomed to consider as nearly destitute of organs, are, in fact, beautifully formed, and as perfect in their kind as any other of the Creator's works.

The INVERTEBRAL animals which we have now to describe, are placed in a division by themselves, on account of their being without an internal skeleton, consisting of a number of vertebræ, or bones of the back. This distinction is explained in the introductory chapter to the Book of Animals. They have been separated by Lamarck into Eleven CLASSES, namely:—

1. MOLLUSCA, (*soft-bodied animals*,) in general covered with a shell, as, for instance, a snail, or without a shell, as a slug.
2. CONCHIFERA, (*shell-bearing animals*,) with a shell, consisting of two valves, as an oyster or muscle.

3. CIRRHIPEDA, (*with feet like cirri or hairs.*) The inhabitant of the acorn-shell, found on the back of the larger kind of shell fish, &c., is an instance.
4. ANNELIDA, (*with body formed of rings;*) of this class the leech is an instance.
5. CRUSTACEA, (*covered with a hard case,*) Crabs, lobsters, &c.
6. ARACHNIDÆ, *Spiders.*
7. INSECTA, *Insects.* A perfect insect has always six legs.
8. TUNICATA, (*enclosed in a case of a leathery consistence.*)
9. VERMES, *Worms.*
10. RADIARIÆ, (*radiated animals,*) with the different parts of which they are formed, arranged like rays round one common centre, as, for instance, the Star-fish.
11. POLYPI, (*many feet,*) the animal that forms the Coral is a Polypus.
12. INFUSORIA, (*Infusory animals;*) these are found in infusions of vegetable substances in water, and are, in general, too small to be visible to the naked eye.

In the present little book we shall treat of the first five of these Classes.

The Molluscous animals are, on account of their organization, placed first among the invertebral animals, a few of the species resembling, in some respects, the more simply-formed fishes.

The systematic arrangement of the Molluscous animals, considered not only as regards their shells, but having reference also to the anatomical distinctions of the creatures themselves, is a modern study. In ancient authors we merely find a few scattered facts, the beauty of the shells attracting their notice more than the value or nature of the animals.

Although, at the first glance, the inhabitants of shells appear to be beings of a very uninteresting nature, a due consideration of the valuable properties of many, and the usefulness of all, will enable us to perceive,

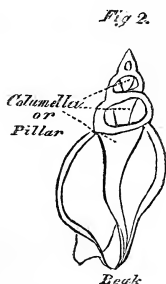
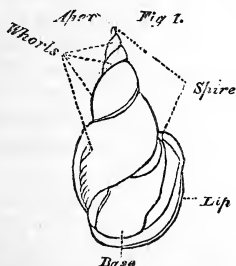
that, regarding them merely in an interested point of view, they are worthy of the strictest attention of the naturalist. In the first place, the whole of them afford food for the different species of fish, and other inhabitants of the deep. The Tyrian dye, the royal purple of the ancients, was produced by the inhabitant of a small univalve shell, of the genus *purpura*. That beautiful ornament in dress, the oriental pearl, is the consequence of disease in a species of muscle, and the inner portion of the shell itself of the same animal is the well-known substance mother-of-pearl. A kind of silk is obtained from the beard of the pinna, which in some places is made into gloves. As an article of food we may mention the well-known oyster, the muscle, scallop, &c., and some of the larger kinds form no small portion of the subsistence of the natives of the South-Sea Islands, and the Negro population in the West Indies.

The *Teredo navalis*, or ship-worm, has, by its destructive powers, ruined the noblest vessels, and rendered useless the timbers on which many of the constructions in harbours mainly depend for security; on this account great attention has been bestowed on its natural history and habits. The Barnacle, which attaches itself to the bottoms of ships, renders the planks so foul as to interfere materially with the rate of sailing of the vessel itself. These are only a few of the useful and noxious qualities of these inhabitants of the deep.

The shell with which a molluscous animal is covered, is absolutely necessary to protect its delicate body from injury; this shell is, in general, composed of much the same substances as bone, but the bone of a bird or quadruped is formed by the agency of the blood, and the particles of which it is composed are deposited by that

fluid, and again taken up and restored to the circulation, a circumstance which does not take place in the substance of a shell. The shell is formed by the deposition of layer upon layer, in the course of the growth of the animal, and the ridges we perceive on many shells, point out their periodical growth.

It will be necessary, when describing the distinctions between shells of different genera, to use several terms, which will, unless properly defined, be, perhaps, unintelligible to young people. The annexed diagrams will explain the meaning of those of most frequent occurrence. Fig. 1 represents a univalve shell; fig. 2, another shell, of the same division, cut through the middle, for the purpose of showing the columella, or pillar. Many shells, as, for instance, the periwinkle, (*Turbo vulgaris*,) have what is called an operculum, (*a lid*,) which closes the opening, and protects the inhabitant from injury. In the case of the periwinkle, this lid is of a horny nature, but in many species it is hard and solid like the shell itself.



CLASS MOLLUSCA.

IN noticing the animal of a univalve shell, the part which more readily attracts notice is the mantle which covers the head of the creature, something like a hood ; it varies much in form and size in different genera. The eyes, which in the sepia are amazingly large and brilliant, in most of the other tribes, although they are frequently visible, are very minute, and would appear, from their formation, to be of little use as organs of sight ; indeed it is supposed, that in the snail they are devoted to the sense of smelling.

The organs of motion in the Mollusca, according to their different form and position, give names to most of the orders ; these consist of muscular expansions of the body, by means of which the animal swims or drags itself along the ground. The gills, or breathing apparatus, are situated internally, and communicate with the air or water, by means of a small canal opening outwardly. The mouth is usually concealed from view when the creature is at rest ; in some this organ is furnished with a hard substance, which supplies the place of teeth, while in others it is in the form of a projecting tube. The greatest portion of these creatures are produced in the water, and the tribes that inhabit that element, exceed by far those that are to be found upon the land.

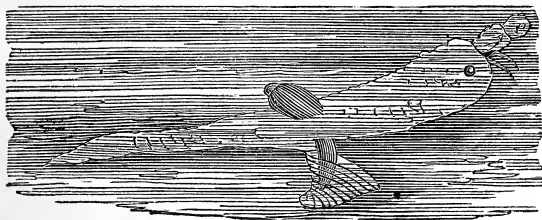
The Molluscous animals have been separated into the five following orders :—

1. HETEROPODA, (*with feet, or organs of motion uncertain.*)
2. CEPHALOPODA, (*with feet, or organs of motion, attached to the head.*)

3. TRACHELIPODA, (*with feet, or organs of motion, attached to the neck, near the gills.*)
4. GASTEROPODA, (*with feet, or organs of motion, attached to the stomach.*)
5. PTEROPODA, (*with feet, or organs of motion, like wings.*)

ORDER HETEROPODA.

THE creatures belonging to this order, says Lamarck, may be considered as the first vestiges of the appearance of a series of marine animals, intermediate in their formation between the fishes and the Cephalopods; they are all natives of hot climates, and possess a body of a jelly-like substance, and so transparent as to be seen with difficulty when floating in the water. They do not all possess shells, and are less known than they otherwise would be, on account of the great difficulty there is in preserving them.



THE GLASSY CARINARIA, (*Carinaria vitrea.*)

This singular and rare animal is found in the southern ocean. It will be seen on referring to the engraving, that the shell which it bears merely covers a portion of its body, that in which the most material organs of the animal are found, namely, the heart and the branchiæ, or organs of breathing. These are most curiously placed

on the upper part of its body, projecting from it and protected by a delicately white and transparent shell, shaped like a little cap, and of a substance resembling glass. The creature is able to enlarge its body by filling it with water, and in swimming the back is undermost. The shell, which seldom exceeds an inch in length, has been sought after by collectors with great assiduity, and has at times fetched as much as ten guineas at a sale; a perfect specimen is very rarely met with. There is a wax model of one of these shells in the British Museum, nearly two inches wide.

ORDER CEPHALOPODA.

THE Cephalopods have been so named by Cuvier from being furnished with a kind of inarticulated arms which surround the head. We find among this class some of the most singular productions of the waters; they differ materially from each other, and have been separated into three groups; first, those without any external shell, as the *Sepia*; secondly, the inhabitants of a shell without any divisions, as the *Argonaut*; and thirdly, those whose shell is divided into numerous chambers, as the *Nautilus*.

THE CUTTLE FISH, (*Sepia officinalis*.)

THE Cuttle Fish, of which there are many different species, is a native of all the temperate and tropical seas. Its body is, in general, of an irregular oval shape, and of a jelly-like substance, and usually covered with a coarse skin, having the appearance of leather. Unlike all other inhabitants of the water which are without a backbone, the *Sepia* possesses two large and brilliant eyes, covered with a hard transparent substance.

attached to sea-weed, rocks, and other marine substances.

The Cuttle Fish generally remains with its body in some hole in a rock, while its arms are extended in every direction, to seize the wanderer that may chance to pass its place of ambush. Its appetite is voracious, and it seizes as its prey every living thing that it has the power to conquer.

The species figured in the engraving is very common on the English coasts, and the bone which is enclosed in its body is frequently found on the sands: it is a well-known substance, and is much employed in the manufacture of tooth-powder. This bone, which, with the exception of the jaws, is the only solid part in the Sepia, differs in shape in the different species; but is always somewhat oval in its form, though varying considerably in texture.

THE ARGONAUT, (*Argonauta argo*.)

The tender Nautilus that steers its prow,
The sea-born sailor in its light canoe.

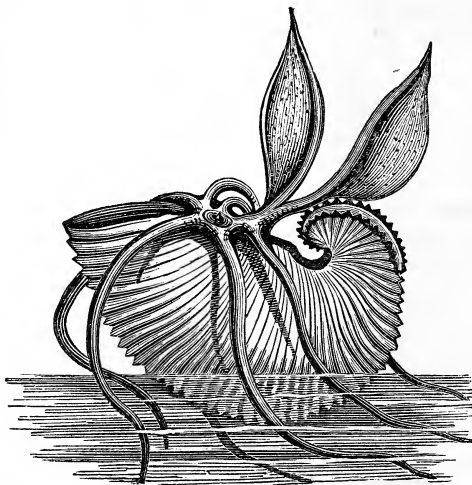
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He, when the lightning-winged tornadoes sweep
The surge, is safe; his home is in the deep.
He triumphs o'er the armadas of mankind,
That shake the world but tremble in the wind.

THE curious inhabitant of this elegant shell has, from the earliest ages, excited the admiration of the student in natural history; and, at the same time, its real place in the system has eluded the research of the most acute observers. The animal agrees in many points with the Sepia or Cuttle Fish, which never possesses a shelly covering, so that, had it been found without that beautiful addition, naturalists would have referred it, without

hesitation, to that particular division of the dwellers in the deep; it is, however, always met with along with the shell; and although there appears to be no bond of union between the tenant and its dwelling, still the purposes to which it applies it, imply at any rate a long-continued occupancy, if they do not absolutely point out the Nautilus as the original architect of the shell.

The name Argonaut has been applied to this sea-born navigator from its resemblance, when floating on



THE ARGONAUT, OR PAPER NAUTILUS.

the surface of the waves, to a vessel in full sail, Argo being the name of the ship which was supposed to have been the first fitted out for commercial adventure.

In calm Summer days, these beautiful little creatures may be seen, in considerable numbers, steering their little barks on the surface of the waters of the Mediterranean. The words of the ancient Roman naturalist, Pliny, give a pleasing description of its habits. "Among the principal miracles of nature," says he, "is the animal called Nautilus or Pompilos: it ascends to the surface of the sea, in a supine posture, and gradually raising itself up, forces out, by means of its tube, all the water from its shell, in order that it may swim more readily; then throwing back the two foremost arms, it displays between them a membrane of wonderful tenuity, which acts as a sail, while, with the remaining arms, it rows itself along, the tail in the middle acting as a helm to direct its course, and thus it pursues its voyage; and, if alarmed by any appearance of danger, takes in the water and descends."

Although the Argonaut has never yet been discovered attached to its shell, some observations which have been recently made on the Pearly Nautilus, which very nearly resembles it, have almost proved that such a connexion does really exist. But whether the shell is formed by itself, or only used to assist the creature in its movements, the instinct displayed is not the less wonderful, or worthy of observation. The Mediterranean, and warmer parts of the Atlantic, abound in these interesting animals, and one species is also found in the Indian ocean.

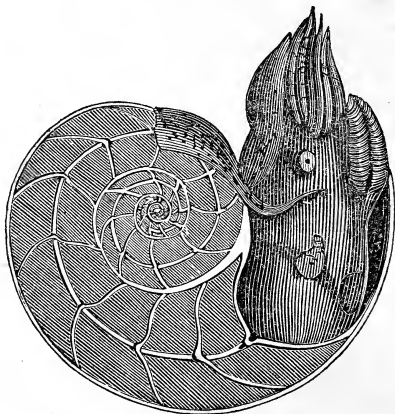
THE PEARLY NAUTILUS,

(*Nautilus Pompilius.*)

THE inhabitant of this singular shell had long been sought after with eagerness by naturalists, and it is only

within these few years that its true nature has been ascertained. We are indebted for this knowledge to the researches of Mr. George Bennet, who, while engaged in a voyage among the Polynesian Islands, captured a specimen containing a living animal, which was brought to England, and is now deposited in the museum of the Royal College of Surgeons in London.

The shell of the Nautilus, as may be seen by the engraving, is divided into numerous cells. The use of these cells to the animal we are now describing was formerly not well understood, but they were supposed to



THE PEARLY NAUTILUS,
Showing the Animal, and a Section of its Shell.

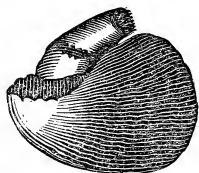
be employed by their inhabitant for the purpose of rising or sinking in the water at will. The body of this *Cephalopod*, it will be seen, only occupies the outer cell

of its habitation, its increased size having rendered it too large to remain in that preceding it. If, as the animal deserted its smaller tenements, one after the other, they had been filled up with solid matter, the shell would have become too cumbersome for its owner; so that we here have another proof of the providing care of the Creator. We shall describe, in Mr. Bennet's own words, the capture of this interesting object.

"It was on the twenty-fourth of August, 1829, (calm and fine weather, thermometer at noon 79° .) in the evening, when the ship *Sophia* was lying at anchor in Marakini Bay, on the south-west side of the island of Erromanga, one of the new Hebrides group, Southern Pacific Ocean, that something was seen floating on the surface of the water, at some distance from the ship; to many it appeared like a small dead tortoise-shell cat, which would have been such an unusual object in this part of the world, that the boat which was alongside of the ship at the time, was sent for the purpose of ascertaining the nature of the floating object.

"On approaching near, it was observed to be the shell-fish commonly known by the name of the Pearly Nautilus; it was captured and brought on board, but the shell was shattered from having been struck with the boat-hook in taking it, as the animal was sinking when the boat approached, and had it not been so damaged, it would have escaped. I extracted the fish in a perfect state, which was firmly attached to each side of the cavity of the shell." The hood has been stated by Dr. Shaw, as being "of a pale, reddish-purple colour, with deeper spots and variegations," the colour, however, as it appeared in this recent specimen, was of a dark reddish brown.

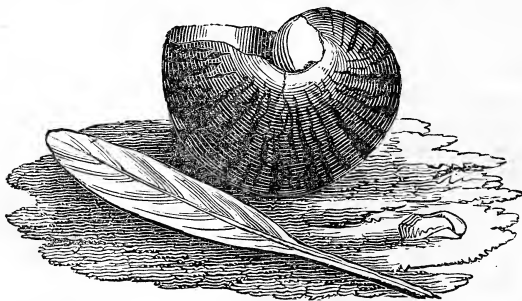
Although this is the only instance of the animal itself having been brought to this country, there is but little doubt of its having been frequently taken, but as the shell was the object of the captors, and not its inhabitant, the latter has been thrown away as useless. An officer in his Majesty's Navy, found a Nautilus in a hole in a reef of rocks, near an island on the eastern coast of



BEAK OF THE NAUTILUS.

Africa; the mantle of the fish, like a thin membrane, covered the shell, which was drawn in as soon it was touched, and the elegant shell was then displayed. "I and others," says the same informant, "when it was first seen, did not notice it, regarding the animal, as the membrane

enveloped the shell, merely as a piece of blubber; but having touched it by accident, the membranous covering was drawn in, and we soon secured our beautiful prize."



SHELL OF THE NAUTILUS; AND THE SEA-PEN, OR INTERNAL SHELL OF THE LOLIGO.

Rumphius, a German naturalist, appears to have been acquainted with its habits; he says, "When he thus floats upon the water, he puts out his head, and all his barbs, and spreads them on the water, with the poop of the shell above water: but at the bottom he creeps in a reverse position, with his boat above him, and with his head and barbs upon the ground, making a tolerably quick progress. He keeps himself chiefly on the ground, creeping sometimes also into the nets of the fishermen: but after a storm, as the weather becomes calm, they are seen in troops floating on the water, being driven up by the agitation of the waves. This sailing, however, is not of long continuance, for having taken in all their tentacles, they upset their boat, and so return to the bottom."

ORDER TRACHELIPODA.

THE Trachelipodes contain by far the largest portion of the univalve shells, and are mostly inhabitants of the waters. They form two numerous groups, the feeders on animal food, (*zoophagi*,) and those that exist on vegetable substances, (*phytophagi*.) The animal feeders are well distinguished from the other group, by having a mouth without jaws, being furnished with a tube which they can retract or advance at pleasure, for the purpose of sucking their nutriment from the bodies of other inhabitants of the deep. The animal feeders are also known from the other section by the possession of a projecting tube called a *siphon*, which conveys the water to the gills. The shell also points out to which section its possessor belonged, from the lower part of its opening being formed either into a sort of canal, or a groove, for the reception of its siphon. They are all

marine animals, and breathe water. The flesh-eating tribes compose five families.

FAMILY CONVOLUTA, (*rolled up like a scroll.*)

FAMILY COLUMELLARIA, (*distinguished by a plated columella.*)

FAMILY PURPURIFERA, (*yielding a purple colour.*)

FAMILY ALATA, (*winged.*)

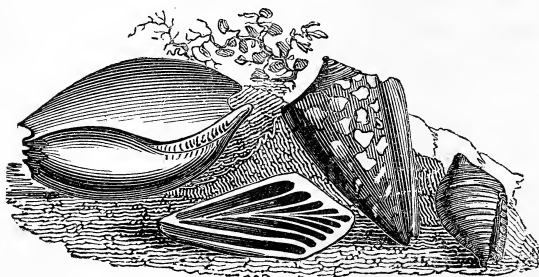
FAMILY CANALIFERA, (*having a canal at the base of the opening.*)

FAMILY CONVOLUTA.

THE convoluted shells contain but few genera; but these are very rich in species, and furnish us with some of the most beautiful specimens of this class.

THE MARBLE CONE, (*Conus marmoreus.*)

LAMARCK notices no less than 181 recent species of the Cone shell. The Marbled Cone figured below, is found in most of the Asiatic seas, and is not uncommon; it is of a dusky colour, and covered with angular white spots.



Voluta diadema.

Conus marmoreus.

Columbella mercatoria.

The section of this shell points out in a remarkable manner the economy and providence of the Creator, so visible in all his works.

It will be seen on referring to the engraving, that the shell is much thicker in the outward part of its coat than in any other part; and this exceeding thickness is necessary for the protection of the soft body of its inhabitant. In the course of the growth of the animal the shell is enlarged, and that part that was external becomes internal, the last made portion of the shell forming the outer wall; if, therefore, the inner part of the shell retained its original thickness, its weight would become too great for its possessor. To guard against this inconvenience, and this useless waste of material, the creature possesses the power of absorbing so much of the substance of what now becomes the internal portion of its dwelling as is unnecessary for its present use, and of re-depositing the same on the outward wall of its mansion, where strength is most required*.

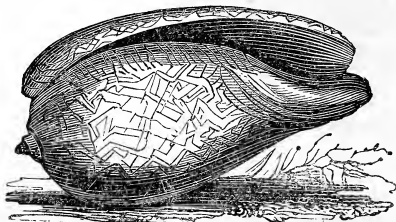
The Cones, says Lamarck, are the most beautiful of all the univalve shells; the genus comprises the most valuable and the most remarkable specimens of this family, whether we look at the regularity of their form or the splendour of their colours. The beauty of many, but, above all, the extreme rarity of others, have given them a species of celebrity, and have caused them to be much sought after by collectors.

The Cones are found in the seas of hot climates, in from ten to twelve fathom water. The animal of the Cones has the head furnished with two tentaculæ or horns, with the eyes on the summits; they only inhabit salt waters.

The genus *Oliva* is distinguished from the Cones by

* This is one of the rare exceptions to the usual plan resorted to by nature in the formation of a shell, as noticed in the introductory chapter.

the groove or canal which separates the turns of their spire, and by the wrinkles on the columella. The Porphyry Olive is found in the South American Seas, on



Oliva porphyria.

the Brazilian coast, and is the most beautiful and the largest species of the genus; it is of a flesh colour, with numerous lines of a reddish brown, forming angular figures of various forms, and covered with irregular-formed spots of a red or maroon colour. Its length is nearly four inches. There are nearly seventy species of this beautiful shell.

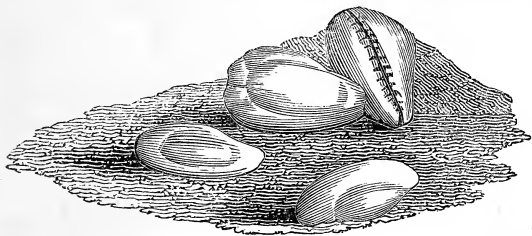
The Money Cowrie of Guinea is very common on the Indian and African coasts; it is used by many of the inhabitants of Africa as a circulating medium; it is also employed for the same purpose in Hindoostan, particularly at Calcutta, where great quantities are obtained from the inhabitants of the Maldivé Islands in exchange for rice.

Many tons of Cowries are annually shipped from England to Guinea; these having been originally brought from the Maldivé Islands to Bengal, and from thence sent into this country. The value of these shells as a

circulating medium depends naturally enough on their greater or less abundance.

In Bengal, in general from 2000 to 2400 are equal in value to a shilling. But in Africa they are much dearer, about 250 being valued at a shilling.

The Cowrie shell is found of three different forms, according to its age. First, in its extreme youth, when



Cypræa moneta.

the shell is extremely imperfect, and is like a slender cone, without any appearance of the usual characters of the genus. Secondly, when half-grown, it then begins to assume the form of the perfect shell, but is extremely slight, and colourless, and the point of its spire projects. Thirdly, when perfect; it has now received a second deposit of shelly matter, in which its specific colours appear, and its spire is completely hidden. The second deposit with which the shell is covered, is secreted by the two membranous wings of the creature's mantle, which, in the adult state of the animal, have rapidly increased and become extremely large, so much so, as to be capable of covering the whole of the shell, while the deposition of the new matter is taking place.

Lamarck says the observations of the habits of this

creature tend to prove that, in addition to the power of completing its shell, as we have already noticed, it can, when its increased size has caused it to require a new habitation, desert its former shell and form a new one; from this it happens that the same individual can form successively many shells of different sizes, so that we find the same species both large and small.

When not in search of food, these animals are found buried in the sand, at some distance from the sea-shore, in temperate as well as in hot climates.

FAMILY COLUMELLARIA.

THIS family is distinguished from the next in having the columella plaited and a notch at its base. It does not include any shells with a plaited columella, in which the opening at the base is entirely smooth, that is, without a notch.

VOLUTA DIADEMA.

THE diadem whorl shell is a very beautiful specimen of its genus; it is marbled with white upon a yellow ground, but the markings become nearly obliterated by age: it is as much as seven inches in length, and is found in the Asiatic seas. The head of the animal of this shell has two pointed tentaculæ, with an eye at the outer base of each. Its mouth is a lengthened cylindrical and retractile tube, furnished with little hooked teeth; it has also a tube to conduct the water to the branchiæ, springing out obliquely behind the head.

COLUMBELLA MERCATORIA.

THE common Columbella is found in the Atlantic Ocean on the coasts of the island of Gorée, and in the West

India Islands; it is about three quarters of an inch in length. It is a sea-shell, and is found upon the coast; it possesses a very small oval operculum attached to its foot.

FAMILY *PURPURIFERA*.

THE notch at the base of the shells of this family is a kind of groove bent backwards and upwards, but not properly forming a canal; all the genera have an operculum. The name *purpurifera* has been given to these Trachelipodes, because some of the genera contain in a peculiar reservoir the colouring matter with which the Romans dyed their beautiful and well-known purple, which was so much in use before the discovery of cochineal.

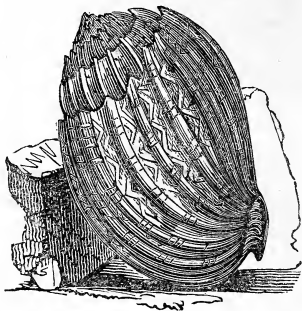
The Partridge Tub-shell, *Dolium perdx*, so called from its colour and form, is found in the seas of all hot climates, and is about four inches and a quarter in length.

The Harp shells are found in the Indian seas, and in great abundance also in the Red Sea. A very curious fact appears in the history of the animal of the Harp, which deserves notice. It was observed a long time back by a German naturalist named Bom, but had since then been either forgotten or disbelieved: a recent traveller has confirmed its truth, although he notices it as a new discovery; it is as follows:—

The foot of the animal has the power of dividing itself into two portions; and one, namely, the hinder portion, can be separated from its body by the animal, when it finds itself suddenly in danger, and wishes to retire into the deepest recess of its shell; on this account it is without an operculum, which would evidently

be useless, as it would be lost at the same time as the foot.

The Harps, says Lamarck, are very beautiful shells, and if they were less common, would, on account of



Harpa musica.

their elegant forms and colours, become valuable in a collection. Some species, however, are still considered rare.

The Harps take their name from the fancied resemblance between the regularity and direction of the ribs on the shell, and the strings of a harp. The species are not numerous, not exceeding eight in number.

PURPURA PATULA.

THIS species of purpura is said to be that which was employed by the Romans in dyeing, but many others of this family yield the same colouring matter. It is nearly three inches in length, and is found in the Atlantic Ocean and the Mediterranean.

The purple colour which this little molluscous animal produces, was discovered by the inhabitants of the ancient city of Tyre, and was thence called the Tyrian Purple. The circumstances which led to the discovery of it are very imperfectly known, but fiction has supplied the want of historical facts, and described its origin with sufficient minuteness of detail. According to one account, the merit of its discovery is due to a dog belonging to a certain Hercules. We are informed that when this dog was accompanying his master along the seashore, who was then following the nymph Tyros, the animal seized one of the *Purpuræ* lying on the sand, and breaking the shell with his teeth, his mouth soon became coloured with the purple juice. The nymph having observed the effect, immediately expressed a strong desire to have a dress dyed of the same beautiful colour; and her lover, no less anxious to gratify her wishes, at last succeeded in discovering a method of applying it to cloth.

This colour was so highly valued by the ancients, that it was either consecrated to the worship of the Deity, or conceived to be fit only for the garments of royalty.

Under the Mosaic dispensation, the stuffs for the service of the altar and the habits of the high-priest were enjoined to be of purple. The Babylonians devoted this colour to the dress of their idols, and most of the other nations of antiquity appear to have done the same thing. Pliny informs us that it was used by Romulus and the succeeding kings of Rome, as well as by the consuls and first magistrates under the republic. The Roman emperors at last appropriated it entirely to their own use, and denounced the punishment of death against those who should dare to wear it, although covered with

another colour. This absurd and tyrannical restriction, confined the dyeing of the Tyrian purple to a few individuals, and, in a short time, the knowledge of the process was entirely lost.

In the twelfth century, neither the creature that furnished the dye, nor the methods which the ancients employed to communicate to cloths the rich and beautiful purple which it afforded, were at all known; and on the revival of learning, it was even suspected by many, that the accounts which had come down to us respecting this celebrated colour were entirely fabulous.

According to Pliny, the Tyrians took the finest colouring matter out of the largest shells, in order to extract the purple more effectually, but obtained the colour from the smaller by grinding them in mills. He adds, that when the *Purpuræ* were caught, the receptacle which contained the dyeing-liquor was taken out and laid in salt for three days; and that after a sufficiency of the matter had been collected, it was boiled slowly in leaden vessels over a gentle fire, the workman scumming off from time to time the fleshy impurities. This process lasted ten days, after which the liquor was tried by dipping wool into it, and if the colour produced by it was defective, the boiling was renewed.

Other colouring matters were employed sometimes to economize, and at other times to vary the effect of the liquors of the *Purpura*. Among these Pliny enumerates *Fucus marinus*, or Archil, and the *Anchusa tinctoria*, or Alkanet, both of which are still used as dyes. By these and other means, the purple colour was made to assume a variety of shades, some inclining more to the blue, and others to the crimson.

In modern times several attempts have been made to

obtain this colouring matter; but the discovery of cochineal has rendered it a matter of little import.

In the year 1683, Mr. William Cole of Bristol being at Minehead, was told of a person living at a seaport in Ireland, who had made considerable gain by marking with a delicate and durable crimson colour, fine linen that was sent to him for that purpose, and that this colour was made from some liquid substance taken from a shell-fish. Mr. Cole being a lover of natural history, and having his curiosity thus excited, went in search of these shell-fish, and after trying various kinds without success, he at length found considerable quantities of a species of *buccinum* on the sea-coasts of Somersetshire and the opposite coasts of South Wales. After many ineffectual endeavours, he discovered the colouring matter placed in a white vein lying transversely in a little furrow or cleft next to the head of the fish, "which," says he, "must be digged out with the stiff point of a horse-hair pencil made short and tapering, by reason of the viscous clamminess of the white liquor in the vein, that so by its stiffness it may drive in the matter into the fine linen or white silk intended to be marked." Letters or marks made in this way with the white liquor in question, "will presently appear of a pleasant green colour, and if placed in the sun will change into the following colours, that is, if in Winter about noon, if in the Summer an hour or two after sunrise, or so much before setting, (for in the heat of the day in Summer the colours will come on so fast that the succession of each will scarce be distinguishable,) next to the first light green will appear a deep green, and in a few minutes this will change into a full sea-green, after which, in a few minutes more, it will alter into a watchet

blue, and from that, in a little time more, it will be of a purplish red, after which, lying an hour or two, (supposing the sun still shining,) it will be of a very deep purple red, beyond which the sun can do no more."

"But the last and most beautiful colour after washing in scalding water and soap, will (the matter being again exposed to the sun or the wind to dry,) be a much different colour from all those mentioned, that is, a fair bright crimson, or near to the prince's colour, which afterwards, notwithstanding there is no styptic to bind the colour, will continue the same if well ordered, as I have found in handkerchiefs that have been washed more than forty times, only it will be somewhat alloyed from what it was after the first washing."

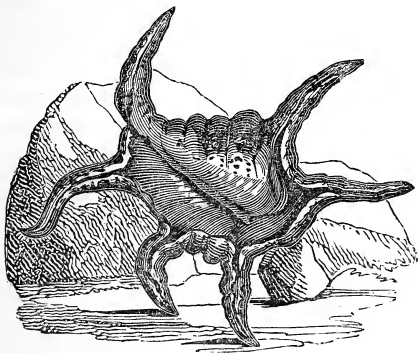
Some years after this, Réaumur discovered great numbers of a species of buccinum on the coast of Poitou, and the stones round which they had collected were covered with small oval masses, some of which were white, and others of a yellowish colour; and having squeezed some of them on the sleeves of his shirt, in about half an hour he found it stained of a fine purple colour, which he was unable to discharge by washing. In repeating his experiment on his return home, he found it was necessary that the cloth should be exposed to the direct rays of the sun.

The difficulty of procuring and preserving a sufficient number of these shell-fish, must always render the use of this colouring matter very limited; but Dr. Bancroft is of opinion that it might still be rendered beneficial in staining or printing fine muslins, for which purpose but little colouring matter is required. No substance, he remarks, will afford a substantive purple of equal beauty

and durability, and capable of being applied to linen or cotton with so much simplicity and expedition.

FAMILY *ALATA*.

THIS family is distinguished by having a canal of variable length at the base of its opening, and by the fact of the right margin of the shell changing its form during the growth of the animal.



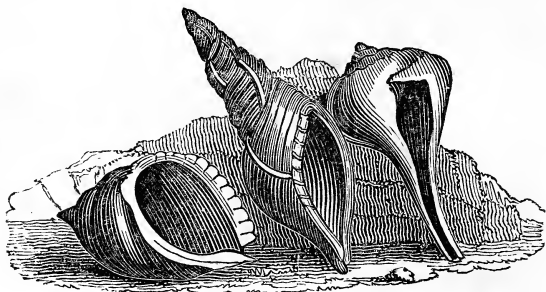
Pterocera scorpio.

This curious shell is found in the East Indian seas, and attains a considerable size, as much as six inches. In an early age the projecting claws of this shell are very small, so that its appearance is materially different from that which it assumes at a more advanced period of its growth. It is known as the spotted Scorpion shell, and is distinguished from other species of the same genus by the knotted and granulated appearance of its surface; the opening of the shell is long and narrow,

and of a dull violet red, sometimes brownish, on which numerous transverse wrinkles are seen, either of a pure white or slightly tinged with yellow.

FAMILY CANALIFERA.

THE shells belonging to this family agree with those of the last in having a canal at their base; but the lip to the right of the opening does not change its form through age.



Dolium perdix.

Triton variegatum.

Pyrula caniculata.

The *Triton variegatum*, or variegated Sea Trumpet, a large and beautiful shell, sometimes as much as two feet in length, is found chiefly in the torrid zones, near the Asiatic coast. The attendants on the sea-gods of pagan Rome are frequently represented with this shell applied to their mouth by way of a trumpet.

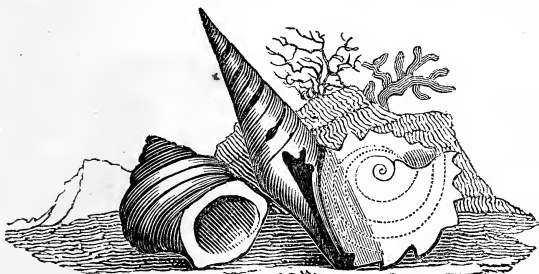
THE CANICULATED PEAR-SHELL, (*Pyrula caniculata*,)

THIS shell is found in the Icy sea, and on the coast of Canada, and attains the length of seven inches. The

animal of the pyrula is at present unknown. There is a kind of keel or ridge along the edge of the whorls, which is obliterated in very old specimens. There are as many as eight-and-twenty species of this shell.

PLEUROTOMA BABYLONIA.

THE Babylonian Split-mouth is found in the East Indies and the Molucca Islands, and is about three inches and



Turbo marmoratus. *Pleurotoma babylonia.* *Trochus imperialis.*

a quarter in length. It is said that the animal of this shell, when in motion, has its foot separated as it were from its body by a long thick footstalk, which arises from the centre of the mantle, which is at this time turned back over the shell. This separation of the foot has the effect of causing the creature to tumble over frequently, from the great weight it has to support.

Those genera of the Trachelipodes which live on vegetable substances, have no projecting siphon, but possess a mouth furnished with jaws; they are in general land-shells, and consequently, the air which they breathe is conveyed directly to their branchiæ. Some of their tribes

however, live in fresh water, either in running streams or in stagnant pools: among these, some breathe water and others air. These last are obliged frequently to come to the surface for the purpose of breathing,—others again inhabit salt water, and are unable to exist out of that element.

TURBO MARMORATUS.

THERE are as many as thirty or forty species of the Turban shell. The Marble Turban, *Turbo marmoratus*, is the largest, being as much as four inches across; it is found in the Indian Ocean. The colour of this shell is of a brownish green, of greater or less intensity. It is ornamented by eight or ten narrow transverse belts, consisting of a series of white or brownish spots; this is one of those shells whose substance, after the outer coat is removed, is of the nature of mother-of-pearl.

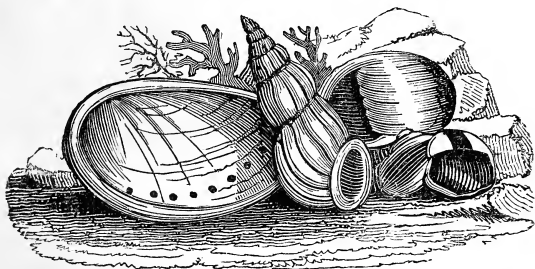
The *Turbo littoreus* (the Shore Turban), is the well-known periwinkle, with which our rocky coasts abound.

TROCHUS IMPERIALIS,

THE Imperial Top-shell. These shells are so called from their resemblance to a boy's top. They are all marine shells, and the apex of their spine is always very sharp-pointed. In some places they are called *flat-mouthed snails*. The greater number of these shells, (and the species are very numerous), are of a beautiful pearly substance, and many of them are also elegantly marked with longitudinal ribs; there are as many as seventy species,—the larger and more elegant are only found in the seas of hot climates.

SCALARIA PRETIOSA.

THIS shell is noted for its rarity, and for the singular arrangement of its whorls, which do not touch each other, and appear as if they were only connected by the ribs with which the shell is adorned. Like the Turbans, the inhabitants of the *Scalariæ* are found on the sea-coast, on rocks and large stones, between high and low water mark. The native place of the *Scalaria pretiosa* seems to be uncertain; Lamarck, and several others, believe it comes from the East Indies, while others consider it an inhabitant of the Mediterranean. So great was the rage some years back, to possess a perfect specimen of this

*Haliotis iris.**Scalaria
pretiosa.**Neritina
pulligera.*

shell, that as much as twenty or thirty pounds, and even more, has been given for a well-preserved specimen; older travellers relate that the *Scalariæ* are much sought after and highly prized by the women on the coast of Amboyna, and at Batavia, where they are used as earrings, and in forming necklaces. They are, although rarely, as much as four inches in length. It is said,

that there was a specimen in the cabinet of the empress Catherine of Russia, still larger; but the most usual size is from one to two inches in length. A fine specimen of this shell ought to be semi-transparent like porcelain, of a light brown, tinged with rose-colour, and the ribs of a beautiful opaque white.

HALIOTIS IRIS.

THE *Haliotides*, or sea cars, are very splendid shells; the species are numerous, and some of them are extremely common. The place in the system which this shell ought to occupy, appears to have caused many doubts in the minds of modern naturalists, and consequently, we find it continually shifted from one part to another in the different works of Lamarck and Cuvier. When moving from place to place in search of food, the animal and its shell present a very pleasing sight, the slender tentacula which appear through the different holes which ornament the margin of the shell, gracefully waving in all directions; these tentacula are supposed to be breathing-tubes. In the young shell, the number of perforations is not so great as in an adult, one being formed at each progressive stage of the creature's growth. Sometimes the holes which were first formed become, by age, filled up. The proportions of the shell, also, vary materially, so as to render the separation of species very difficult and uncertain.

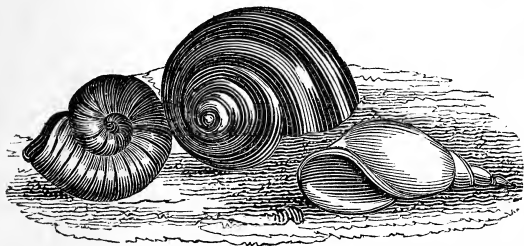
NERITINA PULLIGERA.

THIS shell is found in the rivers of India, and is about an inch and a quarter in length. All the species of this genus are supposed to inhabit fresh water only. There is a curious fact attached to the history of the Neritina,

and of a neighbouring genus, *Nerita*,—namely, the when found in a fossil state, their colours are always in good preservation. The species, which are tolerably numerous, are in general natives of hot climates.

PALUDINA VIVIPARA.

THE animal of the genus *Paludina* is an inhabitant of fresh waters: it takes its specific name from the fact of the young being hatched within the parent shell, and



Planorbis corneus. *Paludina vivipara.* *Lymnæa stagnalis.*

deposited in the waters perfectly formed. In nearly the whole of this class the eggs are laid either in water or in the earth, and afterwards hatched after a longer or shorter period.

These shells are found generally in running streams of fresh water; sometimes, however, they are met with in brackish water, at the mouths of rivers. The operculum of the *Paludina* is of a strong horny substance. The young, immediately they are hatched, attach themselves to the outside of the shell of the mother, where they remain until they are sufficiently strong to trust themselves in the water.

LYMNÆA STAGNALIS.

THE *Lymnæa stagnalis* is found in stagnant waters, particularly narrow ditches, in great abundance. As it breathes air, it is necessary for its existence that it should frequently resort to the surface of the water; and consequently, we find these shells floating about in great numbers, with the body partly out of the shell. The least appearance of danger causes a *Lymnæa* to withdraw the whole of its body into its shelly covering; and as this increases its specific gravity, it instantly sinks to the bottom, where it remains in safety. In order to reach the surface again, it is obliged to crawl to the side of the ditch, and when it has reached the level of the water it again trusts its little bark to the mercy of the winds, for it has very little power to direct its own course.

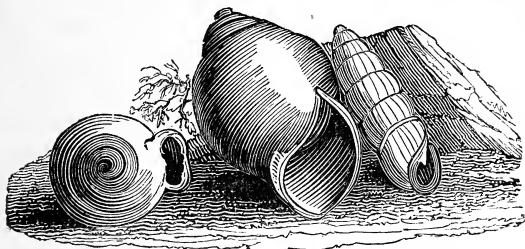
During the Winter, these creatures remain at the bottom, buried in the mud, and in a state of torpor. Although apparently useless to mankind, they form part of the subsistence of many water-birds, and of fishes, which are extremely fond of them. The species of this shell are not easily decided, since they bear so great a resemblance to each other.

PLANORBIS CORNEUS.

THE *Planorbis*, although differing in form from the *Lymnæa*, possesses the same habits, and is found in the same localities. The jelly-like substance which is frequently found, in the Spring of the year, attached to water-cresses and other aquatic plants, and which is considered by many to be of a poisonous nature, and looked on as the spawn of toads, is merely the covering of the ova of this and other inhabitants of fresh-water shells; and although very disagreeable, certainly not poisonous.

BULIMUS HÆMASTOMUS.

THE *Bulimus hæmastomus* is a most beautiful shell; it is a native of Guiana, and is frequently as much as four inches in length. The most singular part of its natural history is the large size of the egg of the animal

*Bulimus hæmastomus.**Pupa mummia.*

in comparison with its magnitude; this is said to be as large as that of a moderate-sized pigeon.

PUPA MUMMIA.

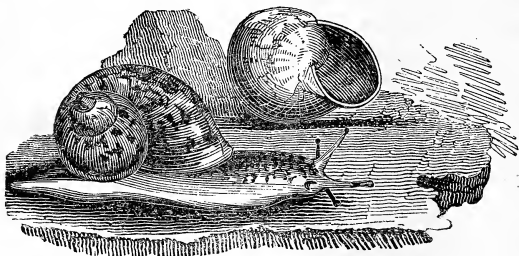
THE *Pupa mummia* is found in the Antilles; it takes its name from the singularity of its form, which very much resembles that of a mummy.

The Pupa is essentially a land-shell, living among grass, on stones, and sometimes in places much exposed to the heat of the sun. The greater number of the species, which are very numerous, are natives of tropical countries; there are, however, several found in Germany, and other parts of the Continent, but they are extremely small.

HELIX NEMORALIS.

THE Snail (*helix*) is an animal well known in every part of the globe, and its species are still extremely

numerous, although many shells which belonged to this tribe, under the Linnæan arrangement, have been placed in other divisions. The head of the Snail is furnished with two pair of tentacula, or feelers; these, unlike similar appendices in other mollusca, are retractile; that is, they can be withdrawn into the body at the will of the animal. The use of these tentacula is uncertain. At the top of each of the longest pair we find a black spot; these spots have been supposed to be the eyes of the animal, and a celebrated anatomist says, that he has discovered in them all the component parts of perfect eyes. However this may be, the animal appears to use them rather as organs of touch than of sight. Some writers suspect that the sense of smell resides in one or both pairs of these appendages.



Helix nemoralis.

The uses to which Snails are applied are not many; some of the larger kinds, however, are, in many countries, employed as food. The Romans, according to Pliny, consumed large quantities, and considered them in the light of delicacies, and considerable pains were taken in

fattening them for the table. Those from Sicily and the Balearic Islands were in great request, and attained a very large size. Some authors say they are still used as food in several parts of the Continent.

In Paris, London, and many large towns, great numbers of Snails are frequently brought to market; but these are not employed as food, but are used medicinally by persons suffering under consumption, and other diseases of the chest.

It was already known that polypi, and some species of worms, could have portions of their body cut off, and that the parts removed would be afterwards reproduced; and as these animals had no well-distinguished extremities, such as heads or limbs, the fact, although singular, was not disputed; but, when it was asserted by Spallanzani, that Snails, which have a very well-defined series of parts, could, after the head was removed, reproduce that portion of the body, the scientific world became naturally incredulous, and numerous experiments were made, and thousands of Snails slaughtered, to ascertain the fact. No one, however, for a length of time, could succeed;—it was then suspected that Spallanzani had only removed a portion of the head. At length, it would appear, from the experiments of M. G. Tarenne (an account of which appeared in 1808), that these creatures could actually reproduce a complete head. He gives as a reason of the want of success of others, the little precaution taken to provide the mutilated Snails with proper nourishment. The new head, according to him, is perfect in about two years after the old head has been removed.

M. Tarenne says, that after having cut off the heads of two hundred Snails, he threw them all into a moist spot at the end of his garden, that they might obtain

the nourishment most fitted for them (how they could eat without their heads he does not say); at the end of the Summer he examined all the mutilated Snails he could find, and he discovered that they all had a new head, about the size of a grain of coffee; they had four small tentacula, a mouth, and lips; at the end of the following Summer, the heads were perfectly reproduced, and like the original head, with the exception of the skin, which was more delicate. "After this experiment," says a French author, "we cannot doubt that the entire head of a Snail can be regenerated after it has been removed; however, I cannot disguise the fact, that I have a kind of repugnance at admitting the matter to be entirely beyond dispute."

If the advantages bestowed on man by Snails are not numerous, the disadvantages, or rather inconveniences, produced by them are very considerable; they are particularly destructive in orchards and kitchen-gardens. On this account, many methods have been recommended for the purpose of destroying them. Although many of these are tolerably successful, there is no plan more likely to keep the breed of Snails under, particularly in enclosed gardens, than that of early rising and gathering them, if we may so express ourselves, while the dew is yet on the grass; if then the shells are broken, they become excellent food for poultry. Ducks may sometimes be allowed to wander in the garden, as they do but little damage to the vegetation, and are great destroyers both of Snails and slugs.

A singular account of the instinct of Snails is, perhaps, worth recording.

The garden of a small house, by the side of one of the roads leading into London, was much infested by a

colony of Snails ; the proprietor of this house, desirous of getting rid of the pest, and yet unwilling to kill the Snails, collected them, and threw them unharmed into the road ; but still, he every morning discovered as many Snails among his pinks and tulips as he had removed the previous day ; this somewhat puzzled him, until once, on leaving his house early, he perceived the Snails which he had but an hour before thrown into the dusty road, moving, not in a body, but each from the spot on which it was thrown, in a direct line from that spot to the low wall which encompassed the garden, as if they comprehended the mathematical fact that, “ a straight line is the nearest way from one given point to another.” How were these Snails aware that by moving in that direction, they should arrive at a green spot ? From the road nothing could be visible to them but dust,—from the path, nothing but the wall in front,—but still, although the whole of their path was covered with dust, they proceeded steadily on, until they had surmounted the wall, and reached their old quarters. By what other faculty were they guided but that instinct which supplies the place of the higher powers of the mind, and which is imparted with so liberal a hand to the meanest creature in nature ?

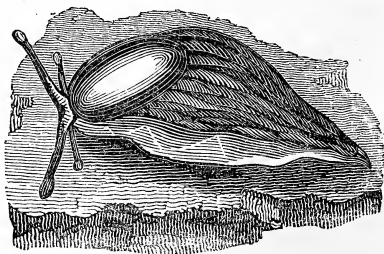
ORDER GASTEROPODA.

THE gasteropods are so called from two Greek words, meaning belly and foot, because the foot, or organ of motion of the animals of which this order consists, is attached to the whole of the under part of the creature, or rather, the belly or under part is itself the foot, and is

for that purpose broad and flat. The gasteropods are also distinguished from the last order, by having a straight body, in no case spiral, and never possessing a shell capable of enclosing the whole body; in some cases, the body is completely naked, and without the protecting covering of any shell whatever.

LIMAX RUFUS.

THE Common Slug is a good example of an individual of this order, entirely wanting a shell. The Slugs, like the Snails, are found in all countries; they are equally destructive to vegetation, but as yet have never been used by man for any useful purpose, if we except the fact of their sometimes becoming the food of ducks and poultry. The *Limax rufus*, red, or more properly brown, Slug, for the colour is of a reddish brown, varying in intensity to such an extent as to render it impossible to find two specimens of the same colour, is more commonly found in fields than in gardens.



Limax rufus.

There are many species of the Slug; but they are not well defined, on account of the variable nature of their

colour; the black and the brown kinds are, however, pretty well known: the black, in particular, is very destructive in kitchen-gardens, and commits great havoc in fields of cabbages and turnips.

In one or two species, the buckler, or smooth space near the head, contains a very small oval shell.

There is a very singular species of Slug found in Teneriffe, under stones in moist places; it is not more than an inch and a quarter in length; it is called *Limax noctiluca*, the night-shining Slug. The buckler in this species is very narrow, and covered with pores, which exude a kind of viscous substance, that has the property of shining with a phosphorescent light, like that of the glow-worm.

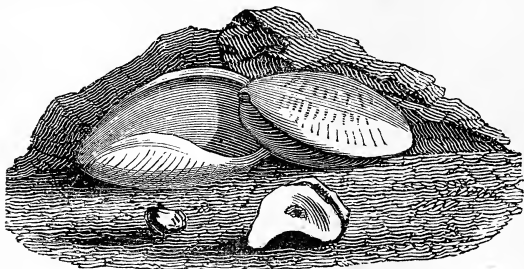
We may have some idea of the rapid increase of Slugs, by a fact mentioned by Dr. Leech, that two individuals of a small species have laid as many as seven hundred and sixty-six eggs; and these eggs were dried in an oven without destroying their vital powers, since, on being placed in a damp place, they were afterwards hatched.

The following plan of taking and destroying Slugs was resorted to by a gentleman near Ipswich. Having heard that turnips were employed to entice Slugs from wheat, he caused a sufficient quantity to dress eight acres to be got together, and then, the tops being divided and the apples sliced, he directed the pieces to be laid separately, dressing two rows with them, and omitting two, alternately, till the whole field of eight acres was gone over. On the following morning, he employed two women to examine the tops and slices, and free them from the Slugs, which they threw into a measure; and when cleared, they were laid on those rows that had been

omitted the day before. It was observed invariably, that in the rows dressed with the turnips, no Slugs were to be found upon the wheat, or crawling upon the land, though they abounded upon the turnips; while on the undressed rows they were to be seen in great numbers, both on the wheat and on the ground. The quantity of Slugs thus collected was near a bushel.

BULLA LIGNARIA.

THE animal of the *Bulla* is singular from possessing within its stomach three pieces of a substance resembling bone; these give that organ the power of crushing or grinding the food, forming a kind of gizzard. The bony



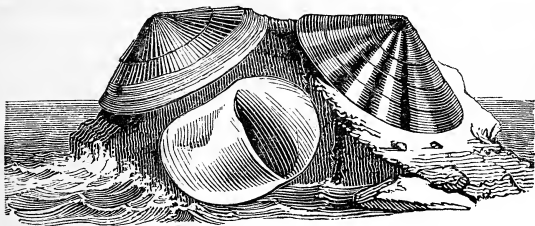
Bulla lignaria.

portion of this stomach is represented in the foreground in the engraving. The *Bulla lignaria* is about two inches and a half in length, and is found in the European seas; Lamarck mentions as many as eleven species.

CREPIDULA UNGUIFORMIS.

THE genus *Crepidula* takes its name from its bearing some resemblance to a little shoe; none of the species

are found in Europe. Of these there are about six, but they are all confined to the seas of warm climates.



*Umbrella
Mediterranea.*

*Crepidula
unguiformis.*

*Fissurella
nimbosa.*

UMBRELLA MEDITERRANEA.

The *Umbrella Mediterranea*, as its name implies, is found in the Mediterranean and in the Gulf of Tarento. The shell of the Umbrella is singular, from the lower part of its circumference being surrounded by a border, of a substance much softer than the shell itself.

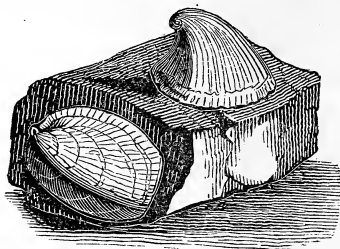
FISSURELLA NIMBOSA.

The *Fissurella nimbosa* (clouded Fissurella) is found in various and distant parts of the world,—in the north of Europe, the western coast of Africa, &c. It has rather a handsome shell, which seldom exceeds an inch and a half in length.

The Fissurella very much resembles our limpet, but differs from it by having a small, rather oval-formed hole in the summit of the shell, affording a passage to a small canal through which the water is discharged, after having passed over the branchiæ.

PILEOPSIS UNGARICA.

THE *Pileopsis Ungarica* (Hungarian bonnet-shell) is extremely elegant both in its form and markings; it is of a delicate white, slightly tinged internally with rose-colour. The animal attaches itself to rocks between



Pileopsis Ungarica.

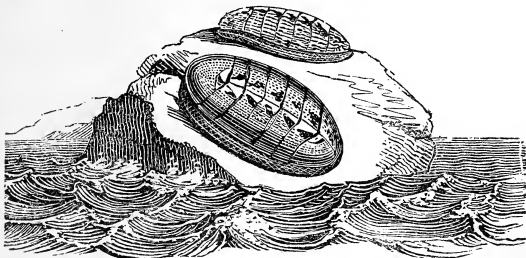
high and low water mark, and very rarely, if ever, changes its situation, unless removed by accident, when it is driven about by the waves, until the creature, being thrown on a rock in a favourable situation, attaches itself firmly to the surface.

CHITON SQUAMOSUS.

THE *Chitons* differ so much from all other shell-bearing animals in the arrangement of their shelly covering, that they have been placed by different naturalists in various parts of their system. Lamarck, in referring to the animal, has placed them near the end of the mollusca.

“Although,” says Lamarck, “when we examine this creature, and observe the several pieces of which its

shell is composed, attached to the marginal membrane of the mantle which surrounds them, it appears not a univalve, but a multivalve shell; yet these shelly pieces ought not to be regarded in any other light than as a lengthened shell of one piece, which Nature had originally broken transversely into several distinct moveable pieces, to give greater freedom to the animal in its movements.



Chiton squamosus.

The Chitons, like the neighbouring genera, frequent the rocks between high and low water mark, but are much more active in their movements. Poli, a learned Neapolitan, in describing the anatomy of a Chiton, says, that the interior of the mouth or throat of this animal is covered with a multitude of teeth,—some simple, and others with three points, and that these teeth are disposed in numerous longitudinal rows.

CLASS CONCHIFERA.

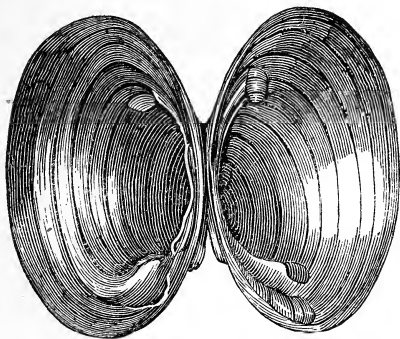
THE Conchifera differ from the molluscous animals that bear shells, in a very great degree; for although the substance of their body is soft, unlike the mollusca it is inarticulate, always enclosed in a shell of two valves, without head or eyes,—a mouth, if it may be so called, concealed from view, and without any hard parts, and the whole body enveloped in a large mantle, or hood, formed of two thin lobes, generally perfectly free, but at times united in front; these are the principal distinguishing characters of this class.

In earlier systems, when shells were classed without much reference to the animals that inhabited them, the only distinction made was the number of pieces of which the shell was formed, and they were arranged under the heads of *univalves*, of one piece, *bivalves*, with two pieces, and *multivalves*, with more than two pieces. This arrangement was inconvenient, as in some cases it separated animals that otherwise agreed with each other. With respect to the bivalve shells, however, this objection does not hold good, as they all contain animals belonging to the class Conchifera.

The individuals of this class appear to be deprived of all the senses except that of feeling. Their powers of motion have been so well described by Dr. Roget, in his *Bridgewater Treatise*, that we cannot do better than extract a portion from that interesting work.

The two valves of the shell of the Conchifera are united at the back by a hinge-joint, often very artificially constructed, having teeth that lock into each other; and

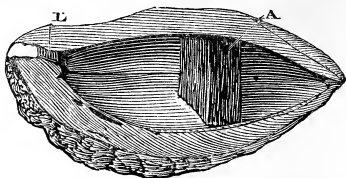
the mechanism of this articulation varies much in different species. The hinge is secured by a substance of great strength.



Valves of the *Unio Batava*, with the Connecting Ligament.

During the life of the animal, the usual and natural state of its shell is that of being kept open for a little distance, so as to allow of the ingress and egress of the water necessary for its nourishment and respiration ; but, as a security against danger, it was necessary to furnish the animal with the means of rapidly closing the shell, and retaining the valves in a closed state. These actions, being only occasional, yet requiring considerable force, are effected by a muscular power, for which purpose sometimes one, sometimes two, or even a greater number of strong muscles are placed between the valves, their fibres passing directly across from the inner surface of the one to that of the other, and firmly attached to both. They are named, from their office of bringing the valves towards each other, the *adductor muscles*.

The simple actions of opening and closing the valves, are capable of being converted into a means of retreating from danger, or of removing to a more commodious situation, in the case of those bivalves which are not actually attached to rocks or other fixed bodies.

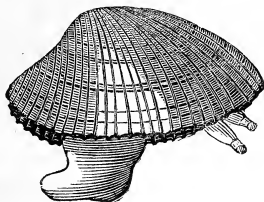


Section of an Oyster, showing the situation of the Hinge, L, the Adductor Muscle, A, and the transverse direction of its Fibres, with respect to the Valves.

Diquemarc long ago observed, that even the oyster has some power of locomotion, by suddenly closing its shell, and thereby expelling the contained water with a degree of force, which, by the reaction of the fluid in the opposite direction, gives a sensible impulse to the heavy mass. He notices the singular fact, that oysters which are attached to rocks occasionally left dry by the retreat of the tide, always retain within their shells a quantity of water sufficient for respiration, and that they keep the valves closed till the return of the tide; whereas, those oysters which are taken from greater depths, where the water never leaves them, and are afterwards removed to situations where they are exposed to these vicissitudes, of which they have had no previous experience, improvidently open their shells after the sea has left them; and, by allowing the water to escape, soon perish.

Many bivalve mollusca are provided with an instru-

ment shaped like a leg and foot, which they employ extensively for progressive motion. In the *Cardium*, or Cockle, this organ is composed of a mass of muscular fibres, interwoven together in a very complex manner, and which may be compared to the muscular structure



The Cardium, or Cockle.

of the human tongue; the effect in both is the same, namely, the conferring a power of motion in all possible ways; thus it may be readily protruded, retracted, or inflected at every point.

The *Solen*, or razor-shell fish, has a foot of a cylindrical shape, tapering at the end, and much more resembling in its form a tongue than a foot. In some bivalves, the dilatation of the foot is effected by a curious hydraulic mechanism: the interior of the organ is formed of a spongy texture, capable of receiving a considerable quantity of water, which the animal has the power of injecting into it, and of thus increasing its dimensions.

The foot of the *Mytilus edulis*, or Common Muscle, can be advanced to the distance of two inches from the shell, and applied to any fixed body within that range. By attaching the point to such body, and retracting the foot, this animal drags its shell towards it, and by

repeating the operation successively on other points of the fixed object, continues slowly to advance.

This instrument is of great use to such shell-fish as conceal themselves in the mud or sand, which its structure is then peculiarly adapted for scooping out. The Cockle continually employs its foot for this purpose; first elongating it, directing its point downwards, and insinuating it deep into the sand, and next, turning up the end, and forming it into a hook, by which, from the resistance of the sand, it is fixed in its position, and then the muscles which usually retract it are thrown into action, and the whole shell is alternately raised and depressed, moving on the foot as on a fulcrum. The effect of these exertions is to drag the shell downwards. When the animal is moderately active, these movements are repeated two or three times in a minute. The apparent progress is at first but small, the shell, which was raised on its edge at the middle of the stroke, falling back on its side at the end of it; but when the shell is buried so far as to be supported on its edge, it advances more rapidly, sinking visibly at every stroke, till nothing but the extremity of the tube can be perceived above the sand.

By a process exactly the inverse of this, that is, by doubling up the foot, and pushing with it downwards against the sand below, the shell may be again made to rise by the same kind of efforts which before protruded the foot. By this process of burrowing, the animal is enabled quickly to retreat when danger presses, and when this is past, it can, with equal facility, emerge from its hiding-place.

The Cardium can also advance at the bottom of the sea along the surface of the soft earth, pressing back-

wards with its foot, as a boatman impels his boat onwards by pushing with his pole against the ground in a contrary direction. It is, likewise, by a similar expedient, that the *Solen* forces its way through the sand, expanding the end of its foot into the form of a club.

The *Tellina* is remarkable for the quickness and agility with which it can spring to considerable distances, by first folding the foot into a small compass, and then suddenly extending it, while the shell is at the same time closed with a loud snap.

The *Pinna*, or Marine Muscle, when inhabiting the shores of tempestuous seas, is furnished, in addition, with a singular apparatus for withstanding the fury of the surge, and securing itself from dangerous collisions, which might easily destroy the brittle texture of its shell. The object of this apparatus is to prepare a great number of threads, which are fastened at various points to the adjacent rocks, and then tightly drawn by the animal, just as a ship is moored in a convenient station, to avoid the buffeting of the storm. The foot of this bivalve is cylindrical, and has, connected with its base, a round tendon, of nearly the same length as itself, the office of which is to retain all the threads in firm adhesion with it, and concentrate their power on one point. The threads themselves are composed of a glutinous matter, prepared by a particular organ. They are not spun by being drawn out of the body like the threads of the silk-worm or of the spider, but they are cast in a mould, where they harden, and acquire a certain consistence before they are employed. This mould is curiously constructed; there is a deep groove which passes along the foot, from the root of the tendon to its other extremity, and the sides of this groove are formed

so as to fold and close over it, thereby converting it into a canal. The glutinous secretion, which is poured into this canal, dries into a solid thread; and, when it has acquired sufficient tenacity, the foot is protruded, and the thread it contains is applied to the object to which it is to be fixed, its extremity being carefully attached to the solid surface of that object. The canal of the foot is then opened along its whole length, and the thread, which adheres by its other extremity to the large tendon at the base of the foot, is disengaged from the canal. Lastly, the foot is retracted, and the same operation is repeated.

Thread after thread is thus formed, and applied in different directions around the shell. Sometimes the attempt fails, in consequence of some imperfection in the thread; but the animal, as if aware of the importance of ascertaining the strength of each thread, on which its safety depends, tries every one of them as soon as it has been fixed, by swinging itself round, so as to put it fully on the stretch; an action which probably also assists in elongating the thread. When once the threads have been fixed, the animal does not appear to have the power of cutting or breaking them off. The liquid matter out of which they are formed, is so exceedingly glutinous as to attach itself firmly to the smoothest bodies. It is but slowly produced, for it appears that no Pinna is capable of forming more than four, or at most five threads, in the course of a day and night. The threads which are formed in haste, when the animal is disturbed in its operations, are more slender than those which are constructed at its leisure. In Sicily, and other parts of the Mediterranean, these threads have been manufactured into gloves, and other articles, which resemble silk.

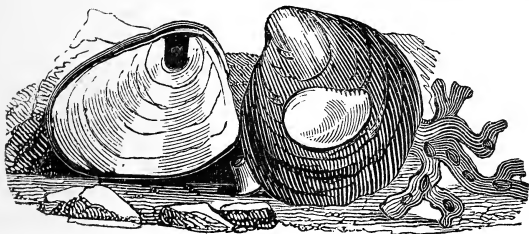
The number of muscles by which the shells are moved have caused this class to be divided into two; the Bimusculosa, in which there are two pair of muscles to perform this office, and the Unimusclosa with only one pair.

ORDER UNIMUSCULOSA.

THE Conchiferous animals which possess but one pair of muscles, are much more limited in number than those which possess two or more; but they contain in their ranks several well-known and useful species, as for instance, the oyster, the muscle, and the shell in which the Oriental pearl is found.

THE ANOMIA.

THE shells of the Anomiæ are exceedingly irregular in their form; like the oysters, they remain during the



*Anomia ephippium**.

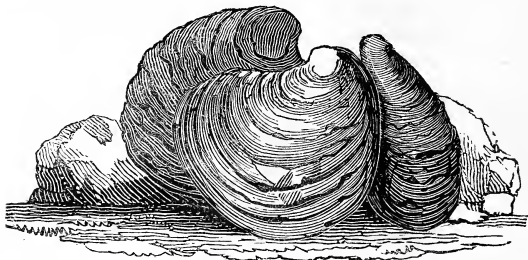
whole of their existence attached to one spot, either on a rock, or on the shell of some larger inhabitant of the deep. These shells are more frequently found in the same places as the oyster, and very commonly attached

* *Anomia*, a little bowl; *ephippium*, a horse's foot.

to the shell of the latter; as an article of food the *Anomia* is of little or no value. Its organization and manner of living are much the same as those of the oyster. The most singular part of it consists in the use made of one of the muscles with which it is furnished, which, instead of being attached to the shell, is fixed to a solid piece of shelly substance, in the form of a cone with the top cut off; this *operculum*, or lid, closes a singular opening in one of the valves of the shell itself. The animal adheres to the rock or other substance by means of this lid, and is detached with great difficulty.

THE OYSTER.

THE Oyster is so well known (*Ostrea edulis*), and so useful an article of food, that we shall bestow more attention on its history than on that of the neighbouring genera.



Ostrea edulis.

Oysters, like all other creatures that have been destined to become food for man, are found in great abundance in most parts of the globe; they are inhabitants of salt waters only, and are always found in rocky ground, in no great depth of water.

Oysters generally cast their spat, or spawn, in the month of May; when first shed it has the appearance of a drop of candle-grease, which the dredgers commonly call *cultch*. The growth of an Oyster is tolerably rapid; three days after the spawn is deposited, the shell of the young Oyster may be seen, nearly a quarter of an inch in width; in three months it is larger than a shilling, in six months bigger than a half-crown, and in a year it exceeds a crown piece in size.

Oysters have been employed as food almost from time immemorial. The Greeks, but more especially the Romans, held them in high repute, attaching, at the same time, great importance to the places in which they were found. Those from the Dardanelles, from Venice, and from England, were considered the best, and the prices paid for them by the luxurious inhabitants of Rome were enormous. They were transported in large vessels, and deposited in the Lake Lucrine, where they were fattened for the table. The Romans, it seems, gave a preference to those which had the border of their mantle of a dark-brown colour, nearly black.

The English oyster-fishery is principally carried on at the following places:—Wivenhoe, near Colchester, in Essex, (the beds here are generally supplied from Portsmouth;) at Feversham, and Milton in Kent, the Swales of the Medway, and at Tenby on the coast of Wales. In Scotland they are chiefly taken at the island of Inchkeith, and at Preston-pans, both in the Frith of Forth. The fishing for oysters is permitted by law, from the 1st of September to the last of April inclusive. During the remaining months they are considered unwholesome; it is a common saying that oysters are in season during all the months that have the letter *r* in them.

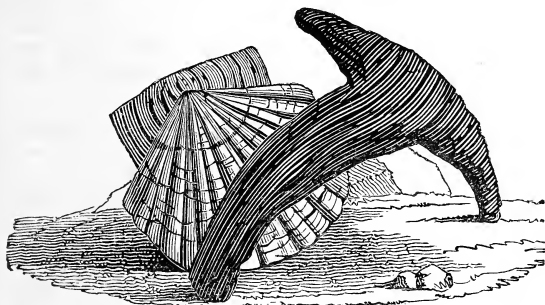
In France, the chief fishing-station for oysters is in the Bay of Cançal, between the town of that name and Mount St. Michael, or St. Malo. The fishery is effected by means of an iron net or dredge; this is drawn over the oyster-bed by hand-labour, or by having the rope which is fixed to it, attached to the stem of the fishing-boat, which is then allowed to run before the wind; frequently, in the course of a few minutes, as many as two or three hundred are taken. The oysters taken are sent from the ports of Granville and Cançal, to different places, where artificial banks or preserves are established. These banks are not only of use in the preservation of the oysters, but assist materially in their improvement. In fact, the oyster, when first taken out of the sea, has frequently a strong muddy taste, and appears in what we should call, bad condition.

Some of these preserves are a species of tank dug in the sand, or sometimes even in stone, near the sea-shore, and communicating by a narrow tunnel with the sea-water, the bottom and sides of these tanks are usually strewed with large stones. In France great care is bestowed on the management of these preserves; the oysters are placed by hand on the stones, with the largest shell downwards, and at times the water is let off, and they are freed from all mud and dirt that may have collected, by having large quantities of water poured over them. A fashion existed formerly in France of preferring those oysters which had a tinge of green, and great pains were taken to cause this change of colour to take place, by placing the animals where they could obtain a peculiar kind of green food.

THE GREAT COMB SHELL,

(Pecten maximus.)

THIS shell, although it has the name of the great Pecten, is not the largest of the numerous tribe to which it belongs; it is found in all the European seas. The regular nature of the fluting with which it is covered, and the elegance of its markings, have brought it much into use among ladies, who employ it in making pin-cushions and other articles of fancy-work; there are about sixty recent, and thirty fossil species.

*Pecten maximus.**Malleus albus.*

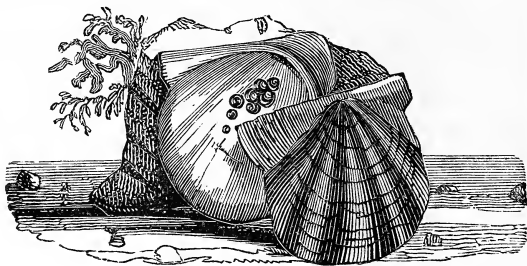
The power of locomotion appears to be very considerable in some species of the Pectens; it is said the animal can raise itself up in the water, and even reach the surface, by moving the two valves of its shell; but this is a fact not quite established, as but little is known of their habits. It is sometimes used as an article of food; but to render it tolerably palatable it requires cooking.

In some countries, the shells of the larger species are used by the poorer classes instead of plates. In Paris, the *restaurateurs* employ them for the same purpose when serving up a certain preparation of mushrooms; in England it is used for cooking scalloped oysters, and the shell is consequently known as the Scallop Shell.

THE PEARL OYSTER,

(*Meleagrina margaritifera*.)

THERE are but two species known of this valuable shell, which are chiefly found in the Persian Gulf, and at Ceylon, or in some of the seas of Australasia.



Meleagrina margaritifera.

The formation of pearl in the shells of this and other inhabitants of the water, has been the cause of considerable dispute, but it is now pretty well ascertained.

The inner portion of the shell of the *Meleagrina* is lined with a pearly substance, which is called mother-of-pearl; this is formed by an animal deposit, and is in thin

layers. If, by any accident, the inner surface of the shell is injured, so as to cause a fracture of the mother-of-pearl, the deposit, in that place, becomes for the future irregular, and a bump is gradually formed. Accidental circumstances cause this bump to assume various shapes; sometimes it is oval, sometimes globular, and at others pear-shaped. This kind of pearl is always originally found attached to the shell by means of a small neck, or footstalk, and the spot at which this neck was placed can always be traced on the pearl itself.

But pearls are at times found loose in the shell;—in this case, the pearly matter is deposited on some extraneous substance, such, for instance, as a grain of sand, and by dissolving the pearl in an acid, this nucleus can be traced.

Some of these round pearls are supposed to be formed on a centre, consisting of the remains of a diseased *ovum*, or egg, of the animal.

Every schoolboy knows the story of Cleopatra having dissolved a valuable pearl in vinegar, and afterwards drunk it off, to show her ridiculous disregard of expense. But the account may reasonably be doubted; for had the acid been strong enough to dissolve the pearl, it would have been impossible to drink it, and if it was weak enough to drink, it would not have dissolved the pearl, at least not until the lapse of a very considerable time.

At the island of Ceylon the fishery for pearls is a matter of great moment. The following is an account of the mode in which it is conducted.

The country round Aripo, on the north-western coast of the island of Ceylon, is flat, sandy, and barren, presenting nothing to the eye but low brushwood, chiefly of thorns and prickly pears (amongst which is the plant

that nourishes the Cochineal*), and here and there some straggling villages with a few cocoa-nut trees. But Condatchy, three miles distant, where, in general, nothing is to be seen but a few miserable huts, and a sandy desert, becomes, during the period of the pearl-fishery, a populous town, several streets of which extend upwards of a mile in length (though, as the houses are only intended as a shelter from the sun and rain, they are very rudely constructed), and the scene, altogether, resembles a crowded fair on the grandest scale. The people most active in erecting huts and speculating in the various branches of merchandise, are Mohammedans, Cingalese (natives of Ceylon), and Hindoos from the opposite coast of the continent of India. Apparently, however, from their natural timidity, none of the Cingalese are divers, and scarcely any of them engage in the other active parts of the fishery; they merely resort hither for the purpose of supplying the markets.

About the end of October, in the year preceding a pearl-fishery, when a short interval of fine weather prevails, an examination of the banks takes place. A certain number of boats, under an English superintendent, repair in a body to each bank, and having, by frequent diving, ascertained its situation, they take from one to two thousand oysters as a specimen. The shells are opened, and if the pearls collected from a thousand oysters be worth three pounds sterling, a good fishery may be expected. The "banks," or beds of oysters, are scattered over a space in the gulf of Manaar, extending thirty miles from north to south, and twenty-four from east to west. There are fourteen beds (not all, however,

* The insect from which our most beautiful scarlet dyes are prepared.

productive), of which the largest is ten miles long, and two broad. The depth of water is from three to fifteen fathoms.

The pearl-oysters in these banks are all of one species, and of the same form : in shape not very unlike our common English oyster, but considerably larger, being from eight to ten inches in circumference. The body of the animal is white, fleshy, and glutinous : the inside of the shell (the real "mother-of-pearl,") is even brighter and more beautiful than the pearl itself : the outside smooth and dark-coloured. The pearls are most commonly contained in the thickest and most fleshy part of the oyster. A single oyster will frequently contain several pearls, and one is on record, as having produced one hundred and fifty.

Sometimes the English government of Ceylon fishes the banks entirely at its own risk ; sometimes, the boats are let to many speculators : but, most frequently, the right of fishing is sold to one individual, who sub-lets boats to others. The fishery for the season of the year 1804 was let by government to an individual for no less a sum than 120,000*l*.

At the beginning of March, the fishery commenced, and upwards of two hundred and fifty boats were employed in the fishery alone. These, with their crews, and divers, and completely equipped with everything necessary to conduct the business of the fishing, come from different parts of the coast of Coromandel. After going through various ablutions and incantations, and other superstitious ceremonies, the occupants of these boats embark at midnight, guided by pilots, and as soon as they reach the banks, they cast anchor, and wait the dawn of day.

At about seven in the morning, when the rays of the sun begin to emit some degree of warmth, the diving commences. A kind of open scaffolding, formed of oars and other pieces of wood, is projected from each side of the boat, and from it the diving-tackle is suspended, with three stones on one side, and two on the other. The diving-stone hangs from an oar by a light rope and slip-knot, and descends about five feet into the water. It is a stone of fifty-six pounds' weight, of a sugar-loaf shape. The rope passes through a hole in the top of the stone, above which a strong loop is formed, resembling a stirrup-iron, to receive the foot of the diver. The diver wears no clothes, except a slip of calico round his loins,—swimming in the water, he takes hold of the rope, and puts one foot into the loop or stirrup, on the top of the stone.

He remains in this upright position for a little while, supporting himself by the motion of one arm. Then a basket, formed of a wooden hoop and net-work, suspended by a rope, is thrown into the water to him, and in it he places his other foot. Both the ropes of the stone and the basket he holds for a little while in one hand. When he feels himself properly prepared and ready to go down, he grasps his nostrils with one hand, to prevent the water from rushing in; with the other gives a sudden pull to the running-knot suspending the stone, and instantly descends: the remainder of the rope fixed to the basket is thrown into the water after him, at the same moment: the rope attached to the stone is in such a position as to follow him of itself. As soon as he touches the bottom, he disentangles his foot from the stone, which is immediately drawn up, and suspended again to the projecting oar in the same manner as before, to be in

readiness for the next diver. The diver, arrived at the bottom of the sea, throws himself as much as possible upon his face, and collects everything he can get hold of into the basket. When he is ready to ascend, he gives a jerk to the rope, and the persons in the boat, who hold the other end of it, haul it up as speedily as possible. The diver at the same time, free of every incumbrance, warps up by the rope, and always gets above water a considerable time before the basket. He presently comes up at a distance from the boat, and swims about, or takes hold of an oar or a rope, until his turn comes to descend again; but he seldom comes into the boat, until the labour of the day is over. When a young diver is training to the business, he descends in the arms of a man completely experienced in the art, who takes great care of him, and shows him the manner of proceeding, and the pupil at first brings up in his hand a single oyster, a stone, or a little sand, merely to show that he has reached the bottom. The length of time during which the divers remain under water, is rarely much more than a minute and a half; yet in this short period, in a ground richly clothed with oysters, an expert diver will often put as many as one hundred and fifty into his basket. There are two divers attached to each stone, so that they go down alternately. The men, after diving, generally find a small quantity of blood issue from their nose and ears, which they consider as a favourable symptom, and perform the operation with greater comfort after the bleeding has commenced. They seem to enjoy the labour as a pleasant pastime, and never murmur or complain, unless when the banks contain a scarcity of oysters, though their labours are continued for six hours.

When the day is sufficiently advanced, the head pilot makes a signal, and the fleet set sail for the shore. All descriptions of people hasten to the water's edge to welcome their return, and the crowd, stir, and noise, are then immense. Every boat comes to its own station, and the oysters are carried into certain paved enclosures on the sea-shore, where they are allowed to remain in heaps (of course, well guarded) for ten days, that time being necessary to render them putrid. When the oysters are sufficiently decayed, they are thrown into a large vessel filled with salt water, and left there for twelve hours to soften their putrid substance. The oysters are then taken up, one by one, the shells broken from one another, and washed in the water. Those shells which have pearls adhering to them are thrown on one side, and afterwards handed to clippers, whose business it is to disengage the pearls from the shells, with pincers.

When all the shells are thrown out, the slimy substance of the oysters remains, mixed with sand and broken fragments of shells, at the bottom of the vessel. The dirty water is lifted out in buckets, and poured into a sack made like a jelly-bag, so that no pearls can be lost. Fresh water being then added from time to time, and the whole substance in the vessel continually agitated, the sand and pearls together, are by degrees allowed to sink to the bottom.

As soon as the sand is dry, it is sifted; the large pearls, being conspicuous, are easily gathered; but the separating the small and diminutive ("seed pearls," as they are called,) is a work of considerable labour. When once separated from the sand, washed with salt water, dried, and rendered perfectly clean, they are sorted into classes,

according to their sizes, by being passed through sieves. After this, a hole is drilled through each pearl; they are then arranged on strings, and are fit for the market.

Pearls have been considered as valuable ornaments from the earliest times: they are mentioned in the book of Job (xxviii. 18), and are often alluded to by the classical writers. There have been various attempts made to imitate them successfully, one of the most singular of which,—known to have been practised early in the Christian æra, on the banks of the Red Sea,—is still carried on in China. A hole is bored in the shell of the pearl-oyster, a piece of iron-wire inserted, and the oyster restored to its place: the animal, wounded by the point of the wire, deposits a coat of pearly matter round it: this gradually hardens, successive layers are added, till a pearl of the requisite size is formed, and the shell is once more brought to land.

A plan somewhat similar to this was employed by Linnæus, who pierced the shells of the fresh-water muscle, causing thereby a pearl to be formed at the punctured spot; and the Swedish government actually established artificial pearleries,—but these were abandoned after a few years; for, although pearls were formed, they were seldom of sufficient size to be of much value.

False pearls are made of hollow glass globules, the inside of which is covered with a liquid called pearl-essence, and then filled with white wax. This liquid is composed of the silver-coloured particles, which adhere to the scales of the Bleak (*Ablette*), and was first applied to this purpose early in the last century by a Frenchman of the name of Jacquin*.

* See Book of Fishes, p. 51.

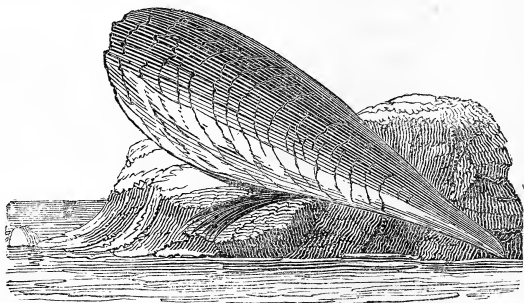
THE HAMMER OYSTER.

(Malleus albus.)

THE singular figure of this shell renders it very remarkable; externally its appearance is very rude and irregular, but, on the other hand, the inner surface is equally beautiful, being covered with the most brilliant mother-of-pearl. The different species of the *Malleus* are all marine, and found in the seas of hot climates, and the rarity of some causes them to be very valuable, and much sought after. Like the neighbouring genera, the animal is furnished with a byssus, or beard, by which it adheres to the rocks.

THE ROUGH PINNA.

THE Pinna is a marine shell, and most of the species are large, and the shells very thin in proportion to their size.

*Pinna rudis.*

That represented in the engraving is found in the American seas, and is sometimes as much as a foot and a half

in length; it is by no means rare. There is a species found in the Mediterranean, in about five or six fathoms water, which is much sought after by the inhabitants of Sicily and Calabria, not only as an article of food, but also for the sake of its beard, of which, in many places, a kind of cloth is made, very remarkable for its softness and warmth. The fishermen, to obtain the Pinna, make use of a kind of iron rake, called a *crampe*, with teeth a foot in length; when the shells are drawn up, the beards are found to be torn in some part of their substance. If a sufficient length remains attached to the animal, to render the fibres available for the purpose of spinning, they are cut off close to the shell; they are then dried and spun, and afterwards woven into gloves, stockings, caps, and even garments of much larger size.

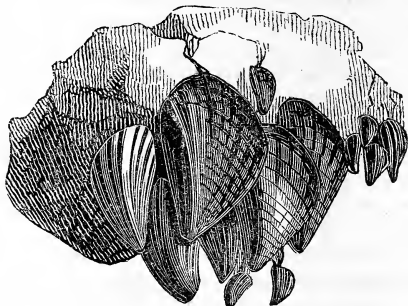
The threads of which the byssus is formed are extremely fine, and of equal thickness throughout their whole length, very strong, and of a dark morone colour, which is exceedingly permanent.

This curious kind of cloth was long since known to the ancients; but at present its manufacture is very limited, from the great scarcity of the Pinna, and the number of beards necessary to make even so small an article as a pair of gloves. But it is supposed, that if the shells were placed in more favourable circumstances, in preserves, &c., they would increase much more rapidly.

These shells are found in the seas of all hot climates, but the British shores possess but one species, the *Pinna lævis* of Donovan; this is of a horny colour, clouded with brown, and attains a considerable size.

THE MUSCLE.

THE Muscles are a well-known and very useful genus of the shell-bearing animals; they are generally found attached to rocks between high and low water marks.



Mytilus edulis.

In every part of the world the muscle is employed as an article of food; and, although not equal to the oyster, it makes a very palatable dish.

The Muscle, although usually wholesome, is at times the cause of severe, though temporary illness. Different reasons have been assigned for this poisonous property, and many signs have been noted, by which it is said the unwholesome state of shell-fish can be detected,—a yellowness of colour, an extremely meagre appearance, partial corruption, a diseased state of the animal, a small crab or insect found between the valves of its shell. Other observers have ridiculously attributed the effects to the change in the phases of the moon; but, if we are to believe a French physician, who made many experi-

ments, all these guesses are wrong; according to this author, the ill effects are caused only after the muscles have been feeding on the spawn of the star-fish; this spawn appears to the eye merely a shapeless lump of jelly, but after a few days it is a living mass of infant star-fish. The time of the year during which this spawn is cast, is from the end of April, or beginning of May, to the end of July or beginning of August; from this he says arises the common observation, that muscles are only poisonous during those months in which the letter *r* is not found. This spawn, according to our author, is so venomous and caustic, that it causes great pain, swelling, and inflammation, even to the hand, if handled at this season; the rubbing the part with vinegar is recommended as a cure. One of the small star-fish was rolled up in other food and given to dogs and cats, who subsequently died. In spite, however, of all these experiments, it is still doubtful whether the true cause has been discovered. Thus much appears to be certain, that whenever indigestion occurs after eating muscles, some ill effects are experienced, but this has seldom, or very rarely, taken place when they have been eaten with vinegar, and they are much more wholesome cooked than otherwise.

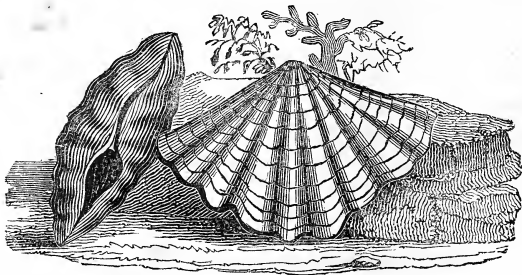
When an individual is *muscled*, the effects are very alarming; the body, head, and face swell to a frightful extent; and in a few hours, the skin is covered with a bright scarlet eruption; the cure is attempted by means of an emetic, and afterwards some aromatic drink, and vinegar and water, this brings on a profuse perspiration, which soon relieves the patient.

The muscle is taken by our fishermen for bait, for which purpose it is well adapted.

In some parts of the Mediterranean great attention is paid to the multiplication of this animal. At the port of Tarento, in the kingdom of Naples, they drive into the sand a number of long poles, to which the spawn of the muscle becomes attached. In the following August, when they have attained the size of almonds, they are taken to the mouth of the brooks and small streams which fall into the gulf; here they are left until October, when they are taken back to the sea, and in the following Spring they are considered fit to eat. This change from the salt to the fresh water and back again, is said to improve their flavour and colour. Near Rochelle they are preserved in tanks, preserves in which the salt water remains at rest.

THE GIANT TRIDACNA.

THE *Tridacna gigas* is the largest of the bivalve shells; it is very thick and close in texture, and is said to have



Tridacna gigas.

been found as much as five hundred pounds in weight. In Catholic countries they have been sometimes used as

the receptacles for the holy water in their churches, and formerly they were considered sufficiently valuable to form a present to a king; those in St. Sulpice, at Paris, were given to Francis the First by the Republic of Venice. They have been found in India, as it is related, of so extreme a size, that more than one hundred persons have made a meal on the flesh of a single *Tridacna gigas*, but this no doubt is an exaggeration. These shells adhere to the rocks by their short and strong byssus with so much tenacity, as to require the assistance of a mallet and chisels in the task of separating them from the rock.

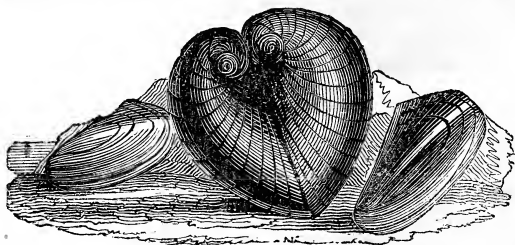
*ORDER BIMUSCULOSA, (Shells with Two Pairs
of Muscles.)*

THIS Order contains by far the greatest portion of the bivalve shells, all interesting to the naturalist, from the variety and beauty of their structure, but few possessing a claim to notice on account of their use as food for mankind, not but that many are equally wholesome with those belonging to the last order, but as they possess two or more pairs of muscles, they are much more capable of moving from place to place, and, consequently, are seldom found in any great quantities in one spot, and being found, as they generally are, in a considerable depth of water, they are not so easily obtained.

THE FRESH-WATER MUSCLE,
(Anodonta cygnæa.)

ALTHOUGH this shell, and several other species which nearly resemble it, are known by the trivial name of

muscle, the only resemblance between them consists in their outward appearance, the animals which inhabit the shells being very distinct, both in organization and in habits. The muscles, as we have already said, have very little power of moving from place to place, while, on the other hand, the Anodonta is at times far from being a sluggish animal, and, for the purpose of shifting its position, it avails itself of a very strong and broad muscular foot. The shell of the Anodonta is sometimes found to contain pearls, a circumstance which frequently occurs in all shells which are lined with mother-of-pearl.



Isocardia cor. *Anodonta cygnæa.*

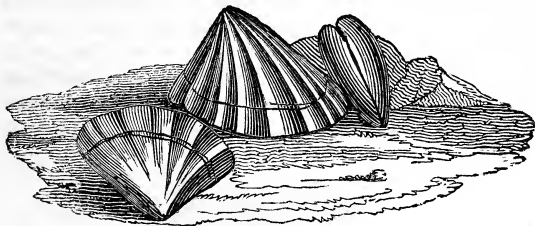
Some of the Scotch rivers have produced numerous specimens of pearl, very large and beautiful, and which used to bear an extremely high price.

THE HEART-SHAPED ISOCARDIA, (*Isocardia cor.*)

THIS shell, which is very common in the Mediterranean, where it goes by the name of the *foolscap-shell*, and the *bullock's-heart shell*, is rare in the British seas, but it is sometimes found on the Irish coast; it is the largest British bivalve shell.

THE WEDGE-SHAPED DONAX.

THERE are nearly thirty species of these shells, all extremely beautiful; that represented in the engraving is of a reddish colour with white streaks; it is often met



Donax cuneata.

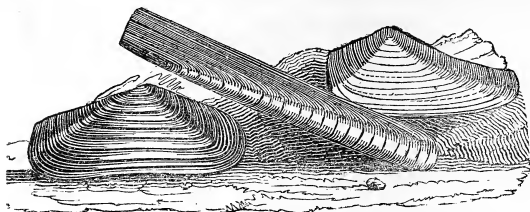
with in collections of Indian shells. One of these species is found on the English coasts, of a delicate white colour, and streaked with pink.

In following the system of Lamarck, we are gradually led through various genera to two species figured on the next page, namely, the Tellina, or *earth-shell*, and the Pandora, and, ultimately, to the Solen, or *razor-shells*.

THE SHEATH SOLEN, (*Solen vagina*.)

THE Solens are singular from the power they possess of burying themselves in the sands on the coast, sometimes even to the depth of a couple of feet. The foot of the Solen, by means of which it is able to penetrate the sand, is equal to one half of the length of the shell. Their movements are confined to rising to the surface of the sand in which they have formed their hole, and

in again sinking to the bottom. This movement is, no doubt, produced by the action of the foot, which forms itself into a sharp point in its descent, and when it remounts is enlarged as much as possible, to form a resting-point, for the purpose of raising the shell to the surface. It is not supposed that the animal ever entirely leaves its hole of its own accord, although it may possess the power; but it is certain, according to the observations of Réaumur, that if forcibly removed it can re-enter it. The hole it forms for its retreat is always perpendicular.

*Tellina.**Solen.**Pandora rostrata.*

One of these creatures, being taken out of its retreat was laid on the sand; it first extended its foot in the form of a wedge, or rather cone, and applying it to the surface of the sand, slightly raised the farthest end of its shell; at the next effort the projecting part of the foot was buried in the sand, and the shell became more elevated; after two or three more attempts the hole had attained a perpendicular direction, and the shell was partly buried in it; the shell then began to descend, and that with considerable quickness.

The solens are used sometimes, but rarely, for food; but in places where they abound, they are sought after

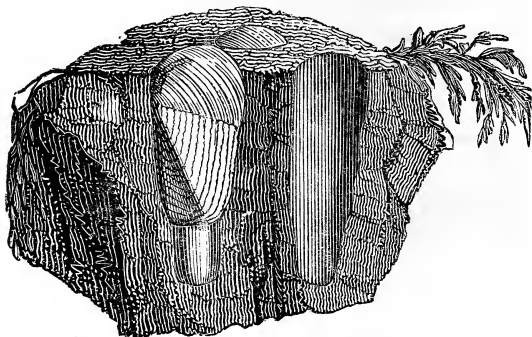
as bait for fishes: the method of taking them is very singular. Having discovered the place of retreat of the creature, by observing the hole in the sand which leads to its chamber, the fisherman throws into its entrance a small quantity of salt. Although an inhabitant of salt water, the pure salt produces so irritating an effect on the extremity of its body, that it quickly mounts to the surface; the fisherman, waiting for its appearance, snatches hastily at it, and if he succeeds in seizing it firmly, makes good his capture; but if not sufficiently active, and the animal escapes, the application of fresh salt produces no further effect; either it is not sensible to the additional infusion of salt, or, which is most likely, the instinct of self-preservation causes it to put up with the inconvenience rather than be taken. In this case, no other means are left of securing it, than using an iron instrument to dig it out with. The number of species is upwards of twenty.

THE DATE-SHAPED PHOLAS.

THESE creatures have much more powerful means of boring than the solens, for not only do they embed themselves in hard clay, but even in stone and lava. In what manner this is effected has been the subject of much dispute; it is almost certain that the process is not mechanical, for their soft body, and the fragile nature of their shells, seem an insuperable bar to such a process. Some authors have asserted that the hole is formed by means of an acid secreted by the animal, which acts chemically on the stone; but there are two reasons against this solution of the difficulty, first, no acid liquid has been discovered in the living animal, and secondly.

although acid would act upon stone, it would have no effect whatever on lava.

Another curious part of the history of these shell-fish is their phosphorescence, which is so bright, that it has been asserted, if eaten in the dark without their being cooked, it appears as if the person devouring them was swallowing phosphorus.



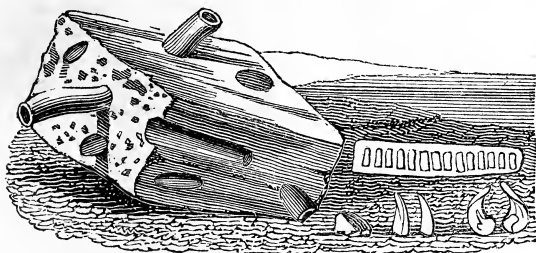
Pholas dactyloides.

Although not used as food in this country, they are not uncommonly eaten on the shores of the Mediterranean, where some large species are found.

The species represented in the engraving is found on the British coasts, embedded in clay; its shell is of a delicate white, beautifully carved. The projecting piece at the lower part of the shell in the engraving is the long foot of the animal; on the right hand, the hole from which a shell has been removed is shown.

THE SHIP-WORM, (*Teredo navalis*.)

BEFORE the anatomy of this destructive creature had been carefully examined, there was as much difficulty in guessing at the means it employed in penetrating the solid timbers in which it is found, as there is with regard to the operations of the Pholas; but subsequent observation shows that the hard parts of which the mouth is formed are fully equal to the task.

*Teredo navalis.*

Perhaps we may say with propriety, that this is the only species of the shell-bearing tribes that is decidedly injurious to mankind. The animal of the *Teredo* is a long worm-shaped creature, dwelling in a tube of a shelly substance, which it forms for itself in its progress through the wood; the small pointed shell-like pieces, to the right in the engraving, form the jaws of the animal. With the assistance of these it cuts its way into the timber, and at the same time lines the excavation it is making with a shelly substance, which gradually is formed into a tube, the animal occupying that part which is most deeply sunken in the timber; in directing its

course it generally excavates in the direction of the grain of the wood, but in some instances it crosses this grain.

In Holland a great part of the country is below the level of high water, and to prevent the irruption of the sea immense dykes have been formed along the coast; these are framed, on the sea-side, of large masses of sand, while to the landward they are strengthened by means of strong piles driven into the ground and wattled together. These piles were once discovered pierced in all directions by this destructive worm, to such an extent as to endanger their safety, and had it not been for a timely discovery of the mischief, immense tracts of country would have been laid under water and irretrievably lost.

CLASS CIRRHIPEDA.

THE Cirrhipeds are well known under the names of *Barnacles* and *Acorn-shells*, being found attached to rocks, ships' bottoms, and pieces of timber which have been under the water for a length of time. They also at times fix themselves on the shells of the larger Mollusca, and on the backs of whales, tortoises, &c. These creatures, from their singular formation, have often proved a stumbling-block in the way of the systematic naturalist, who, from their anomalous characters, was unable to refer them to any part of his system; and although their true nature, which has more recently been discovered, was partially suspected by Lamarck, (without, however, any definite idea on the subject,) we have still placed them immediately after the Conchifera, although, as we shall presently show, they ought more properly to be ranged with the Crustacea, that is, the crab and lobster tribes.

After noticing their resemblance in many respects to the Crustacea, Lamarck thus expresses himself. "In fact, when I established the CLASS of Crustacea, I formed the *first order* of this class, (the *Cirrhipeds*,) under the name of *sightless Crustacea*, but a few years afterwards I separated them and placed them at the end of the Mollusca, but this was no better. If, for example, we consider those characters which furnish their most important organs, we shall find that the Cirrhipeds, without any doubt, most nearly resemble the Crustacea, for they have the same system of nerves, they have jaws

analogous to those of the crustacea, and their tentacula resemble the antennæ of the shrimps." To prove that they really were crustacea, was a task that devolved upon a British naturalist, I. V. Thomson, Esq., a surgeon in his Majesty's forces. The manner in which this discovery took place, we shall notice further on.

The cirrhipeds have obtained their name from the hairy feelers, or tentacula, with which they are provided; the name Cirrhipeda being derived from two Latin words,—*cirrhus* hair, and *pes* the foot; these appendages being figuratively called feet, although they have, in reality, no relation whatever to that organ of motion.

They have been separated into two orders; namely, *Cirrhipeda pedunculata*, which are attached to any object by a tube of a leathery nature, as, for instance, the Barnacle,—and *Cirrhipeda sedentaria*, which are fixed directly to the rock, like the Acorn-shell.

ORDER CIRRHIPEDA PEDUNCULATA,

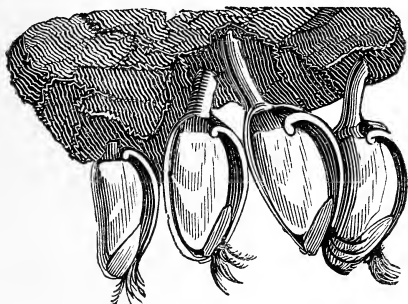
(*Cirrhipeda with a Footstalk.*)

THE SMOOTH BARNACLE,

(*Anatifa lævis.*)

THE curious popular error, that the Barnacle contained the young of a species of goose, which was thence called the Barnacle Goose, has lasted for many ages, and still prevails among the uneducated, on the shores of all the European seas. One reason of the continuance of this error in several Roman Catholic countries, is the permission granted by the priest to its members, to eat this goose on fish-days, because it is considered, on account

of its supposed watery origin, to partake more of the character of a fish than a fowl. To show the extent to which an erroneous belief may be carried, we may quote the following notice sent by Sir Robert Moray to the Royal Society, and *printed* by them in their *Transactions*. He says, "The pedicle seems to draw and convey the matter which serves for the growth and vegetation of the shell and the little bird within it." "In every shell



Anatifu lævis.

that I opened, I found a perfect *sea-fowl*; the little bill like that of a *goose*, the eyes marked; the head, neck, breast, wings, tail, and feet formed; the feathers everywhere perfectly shaped, and blackish coloured; and the *feet* like those of other water-fowl, to my best remembrance." "Nor did I ever see any of the little birds alive, nor met with anybody that did; only some credible persons have assured me that they have seen some as big as their fist!!"

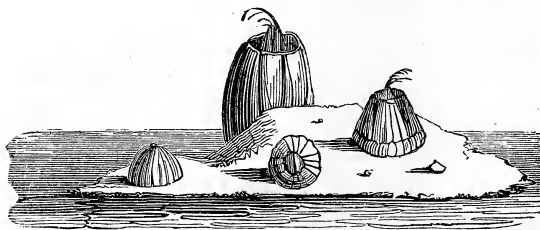
Mr. Thomson describes his discovery of the real nature of the Barnacles, in these words. "On April 28, 1823,

which the author had devoted to the investigation of some marine productions, he was returning home without any addition to the stock of knowledge, when, casually throwing out a small muslin towing-net, on crossing the ferry at Passage, such a capture of marine animals was made, as furnished a treat, which few can ever expect to meet, and could hardly be excelled for the variety, rarity, and interesting nature of the animals taken." After mentioning the names of several very rare species, he continues "and others perfectly nondescript, and incapable of being associated in any of our classifications of the crustacea; of this description is the little animal about to be described."

ORDER CIRRHIPEDA SEDENTARIA, (Sedentary Cirrhipeds.)

THE ACORN-SHELL.

"THERE is a small translucent animal one-tenth of an inch long, of a somewhat elliptic form, moderately com-



Balanus, (The Acorn-Shell Barnacle.)

pressed, and of a brownish hue. When in a state of perfect repose, it resembles a very minute muscle, and

lies upon one of its sides at the bottom of the vessel of sea-water in which it is placed. At this time all the members of the animal are withdrawn within the shell, which appears to be composed of two valves, united by a hinge along the upper part of the back, and capable of opening from one end to the other along the front, to give occasional exit to the legs. The limbs are of two descriptions; namely, in front a large and very strong pair, provided with a cup-like sucker and hooks, &c., and at the hinder part of the body, six pair of swimming-members, so articulated as to act in concert, and to give a very forcible stroke to the water, so as to cause the animal, when swimming, to advance by a succession of bounds, after the manner of the water-flea.

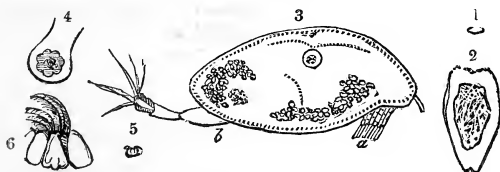


Fig. 1. Young Barnacle, natural size,
 2. ————— magnified, seen from above.
 3. ————— highly magnified, seen from side; *a* swimming-members, *b* front limb with sucker.
 4. Eye much magnified.
 5. Perfect Young Barnacle, natural size.
 6. ————— full grown.

"The greatest peculiarity, however, in the structure of this animal, is the eyes; which, although constantly shielded by the valves of the shell, are placed on foot-stalks, as in the crab and lobster, in front, at the sides of the body.

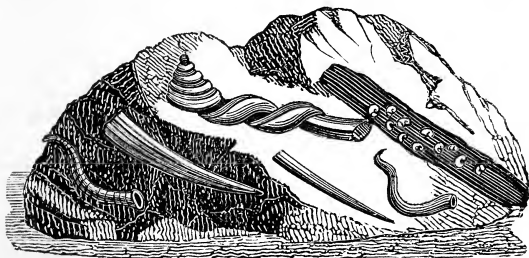
“ Some of these curious creatures were collected in the Spring of 1826 ; and, in order to see what changes they might undergo, were kept in a glass vessel, covered by such a depth of sea-water, that they could be examined at any time by means of a common magnifying glass ; they were taken on May the 1st, and on the night of the 8th, the author had the satisfaction to find that two of them had thrown off their *exuviae**, and, wonderful to say, were firmly adhering to the bottom of the vessel, and changed into young Barnacles ! such as are usually seen intermixed with grown specimens, on rocks and stones at this season of the year. The eyes were still perceptible, although the principal part of the black colouring-matter appeared to have been thrown off with the *exuviae*. On the 10th, another individual was seen *in the act of throwing off its shell*, and attaching itself, like the others, to the bottom of the glass.”

* The skin with which the animal is covered before transformation.

CLASS ANNULATA.

WE cannot better describe the annulose animals than in the words of Lamarck ; he calls them

“ Animals with soft bodies, lengthened, worm-shaped, naked, or inhabiting tubes, with the body divided into segments, or at least transverse wrinkles, often without head, without eyes, and without antennæ, unfurnished with articulated limbs, but the greater number having, instead, small protuberances, bearing spines, and capable of being retracted at pleasure, disposed in rows along the sides, though not quite to the extremity of the body, and assuming various forms. They have also red blood circulating by veins and arteries ; this separates them from the worms, properly so called, which



Shells of various sedentary Annulose Animals.

have white blood. This colour of the blood is a singular fact, since the animals are much less complex in their organization than the Mollusca, which have

colourless blood. The Class of Annulose animals have been separated into three Orders, namely, *Annulata sedentaria*, which are fixed to other substances; *Annulata antennata*, possessing antennæ, or feelers; and *Annulata apoda*, without projecting members answering as feet, serving solely to attach the animal to rocks, stones, &c.

ORDER ANNULATA SEDENTARIA,

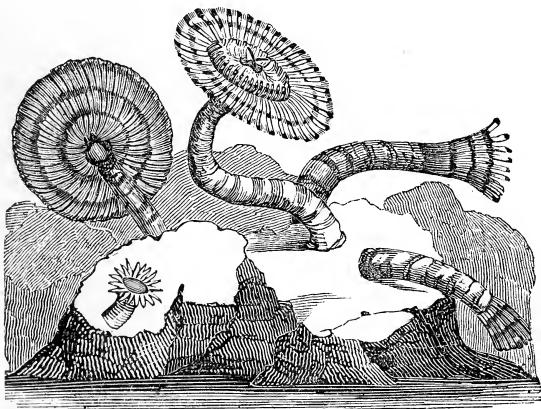
(*Sedentary Annulose Animals.*)

THE creatures which form this order are generally found attached to rocks, shells, &c. and are usually of small size. The engraving represents a variety of species of these animals. Of the genus *Serpula* there are many species, but as it is in general merely the shell that is found in collections, they are but ill defined; some of the species are found in almost all climates. The animal of the *Serpula* has great power of contracting its body, but it never leaves its shell or tube; this tube is gradually lengthened by its inhabitant, who always occupies the most recently-formed portion of it; its *operculum*, the lid with which it closes the opening of its tube, is very prettily formed; it is something like the mouth-piece of a trumpet, but of course not perforated, and it closes the opening with great accuracy.

THE MAGNIFICENT AMPHITRITE.

THIS beautiful species is perhaps the largest of the whole tribe as yet discovered. It is found in various parts of the coast of Jamaica, adhering to, or rather embedded in the rocks. Its irritability is exceedingly

great, and on being approached it instantly retreats into its elastic tube; this tube is of a leathery consistence unlike that of the *Serpula*. Specimens of this elegant species can only be obtained by breaking off such parts of the stone as contain them. These being put into tubs of sea-water, may be kept for months in perfect



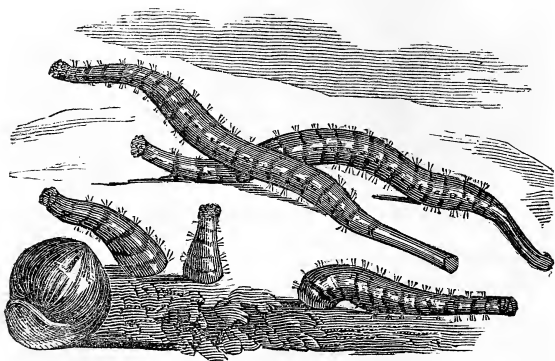
Amphitrite magnifica.

health. That part of the body which is so beautifully spread out like an umbrella, consists of the *branchiæ*, or organs of breathing; these are of a yellowish colour, beautifully marked with pink. The *Amphitrite*, although perhaps it never entirely leaves its tube, is not attached to it, and frequently draws out nearly the whole of its body. .

*ORDER ANNULATA ANTENNATA, (Annulose
Animals possessing Antennæ.)*

THE SAND-WORM OF THE FISHERMEN.

THIS Worm forms its nest in the sand on the sea-shore, and is much sought after by fishermen as bait for fishes.



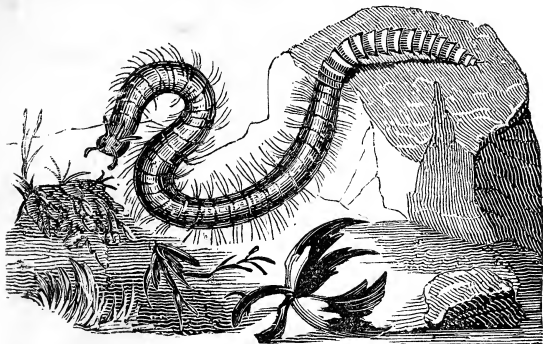
Avenicola piscatorium.

It is found in all the European seas. There appears to be but one species, but that is found in great abundance.

BLOOD-COLOURED LEODICE.

THE Antennated Annulata differ materially from those which are enclosed in a case; they possess, in addition to their antennæ, organs of motion, like the false legs of a caterpillar, and two or four well-formed eyes; they

are all marine animals, and altogether they bear a strong resemblance to the *scolopendra*, or centipede.



Leodice sanguinea.

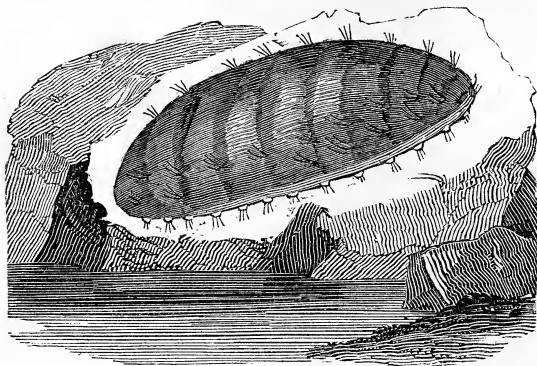
The species represented above was taken on the southern coast of Devonshire; it is the largest English species, extending sometimes to the length of fourteen or fifteen inches.

When the animal was in a glass of sea-water, the circulation of the blood through the bristle-like appendages on each side of the body was a curious object, and appeared to be effected at the will of the animal, but when it became sickly, the circulation was slower, and as soon as it expired all the colour from those parts vanished.

The mouth is large, and placed beneath, concealing most formidable jaws, or complicated fangs, which were put forward occasionally as the animal became sickly, or in the agonies of death. The figure beneath the worm shows the shape of this singular apparatus.

THE SPINOUS SEA-MOUSE, OR SEA-CATERPILLAR.

THE Sea-Mouse is found in the European seas, and when in its native element is singularly beautiful, the



Hatithæa aculeata.

hair with which it is partially covered being equal in splendour to the colours on the tail of a peacock.

ORDER ANNULATA APODA, (*Footless Annulose Animals.*)

THE greater portion of the Annulose animals, namely those already described, are furnished with small projecting points on the sides of their body, which assist them in their motions, and which may, consequently,

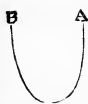
be considered as supplying the place of feet; but those we have yet to notice have no similar appendages, and, therefore, they are called footless. They are all very lively in their movements, and live either in moist earth, or the mud at the bottom of ponds. We find among the footless annulata two well-known genera, namely, the Earth-worm and the Leech.

THE COMMON EARTH-WORM,

(*Lumbricus terrestris.*)

THE body of the Earth-worm is composed of a great number of narrow rings, and along each side are four rows of very small, short, silk-like bristles, of a substance partly horny and partly shell-like. These bristles are placed on the edges of the rings, and it is by the alternate contraction and expansion of these rings that the worm is enabled to move along, the little bristles acting like hooks, and so forming various fixed points of resistance, or *fulcra*, upon which the animal can rest at each movement forwards. The organization of the Earth-worm is very simple, the intestinal canal for the food being a simple straight tube, except in one part of its length, where a kind of gizzard is found, which answers the purpose of a stomach. It is supposed to feed upon the vegetable substances it finds in the earth.

The hole, or burrow, formed in the earth by the worm, has always two openings, one by which it enters, and by which it throws out the dirt which is removed during the progress of its excavation, and the other by which it at times leaves its burrow, so that the hole made

by the animal would be much in this form  descending at A, and reaching the surface by B. It has been said, that the Earth-worm, if divided by the spade or otherwise, will unite again and live; the foundation for this appears to be the more probable fact, that, when divided, that portion of the animal in which the head is placed may, perhaps, survive the mutilation, and ultimately again become a perfect animal.

Although worms, after wet weather, sadly disfigure our gravel walks, they are, at the same time, useful gardeners, loosening the earth round the roots of plants, and thus rendering it more capable of receiving the small fibres of the roots. During the Winter they penetrate very deeply into the ground, and remain, according to Latreille, rolled up in a kind of nest, protected from injury by the discharge of *mucus*, which is furnished by the pores of their body.

The Earth-worm appears to have been a considerable favourite with the author of the *Journal of a Naturalist*; among other remarks, he observes, "There is another creature, and that a very important one in the operations of nature, that is surrounded by dangers, harassed, pursued incessantly, and becomes the prey of all; the common Earth-worm. This animal, destined to be the natural manurer of the soil, and the ready indicator of an approved staple, consumes on the surface of the ground, where they soon would be injurious, the softer parts of decayed vegetable matter, and conveys into the soil the more woody fibres, where they moulder and become reduced to a simple nutriment, fitting for living vegetation. The parts consumed by them are soon returned to the surface, whence dissolved by frosts, and

scattered by rains, they circulate again in the plants of the soil,

Death still producing life.

“Thus eminently serviceable as the worm is, it yet becomes the prey of various orders of the animal creation, and perhaps is a solitary example of an individual race being subjected to universal destruction. The very emmet seizes it when disabled, and bears it away as its prize. It constitutes throughout the year the food of many birds; fishes devour it greedily; the hedgehog eats it; the mole pursues it unceasingly in the pastures, along the moist bottoms of ditches, and burrows after it through the banks of hedges, to which it retires in dry seasons. Secured as the worm appears to be by its residence in the earth, from the capture of creatures inhabiting a different element, yet many aquatic animals seem well acquainted with it, and prey on it as a natural food, whenever it falls in their way: frogs eat it, and even the great water-beetle I have known to seize it, when the bait of the angler, and it has been drawn up by the hook. Yet notwithstanding this prodigious destruction of the animal, its increase is fully commensurate to its consumption, as if ordained the appointed food of all.

Worms, generally speaking, are tender creatures, and water remaining over their haunts for a few days, drowns them. They easily become frozen, when a mortification commences at some part, which gradually consumes the whole substance, and we find them on the surface a mass of jelly. Their retiring deeper into the soil is no bad indication of approaching cold weather; but no sooner is the frost out of the ground, than they approach the surface.

“Earth-worms do considerable mischief to the floriculturist by drawing the young plants, immediately after they are transplanted, into the earth. In the drainage of lands they are of essential service, penetrating the clay that lies beneath the vegetable mould in every direction, and thus forming numerous small canals to carry off the water into the deep trenches dug by the agriculturist.” The author we have already quoted, after concluding this account of the worm, says, “I would advocate the cause of all creatures, had I the privilege of knowing the excellency of them; not willingly assigning vague and fanciful claims to excite wonder, or manifest a base pride by any vaunt of superior observation; but when we see, blind as we are, that all things are formed in justice, mercy, truth, I would tell my tale as a man, glory as a Christian, and bless the gracious Power that permitted me to obtain this knowledge.”

THE MEDICINAL LEECH, (*Hirudo medicinalis*.)

THE medical utility of the Leech seems, even in very remote times, to have been acknowledged by mankind, and accordingly we find it noticed in the writings of many ancient physicians. It was not simply applied to the cases in which it is at present employed, but was recommended to be used in many singular ways: a paste made of the ashes of a burnt leech was said to have the property of removing the hair from any part of the body. It was also employed to suck the blood from a wound occasioned by a mad dog, or any other rabid animal.

At present the employment of the leech is confined to the operation of drawing blood from inflamed parts

of the surface of the body, for which use it is eminently adapted.

There are as many as twelve or fifteen species of these creatures, but only two have been employed in medicine, namely, the *Hirudo medicinalis*, which may be known by having six yellowish lines, or striæ, on its back, while the under-part is of a grayish hue spotted with black; and the *Hirudo troctina*, of a brownish colour, the upper part of the body marked with black spots, each of which is surrounded with a golden-coloured ring, the sides of a dingy yellow, and the under-part of a yellowish green with black spots.

The first of these species, the medicinal leech, is common throughout the whole of Europe, but is much more abundant in the southern parts; it is generally about three inches in length. Formerly it was very abundant in Great Britain, but the improvements in agriculture, and the consequent drainage of the land, together with the great use made of it in medicine, have of late years rendered it of less frequent occurrence. On this account great quantities of leeches are imported; these chiefly come from Bourdeaux and Lisbon. On a moderate calculation it appears that, in England, on an average, out of every hundred of leeches employed, ninety-nine may be considered of foreign production; these differ from the English leech in being somewhat larger, and having the under-part of a uniform colour, without spots. Some idea may be formed of the number of leeches used in medicine by the statement, that in the hospitals of Paris alone, 300,000 were employed in one year. The prevailing colour of the medicinal leech appears to vary according to the nature of the soil on which it is found. In Winter the leech retires to waters

of considerable depth, and seeks shelter in the mud at the bottom ; but in the Summer it appears to delight in shallow pools, basking, as it were, in the warmth of the sun : but if the water it frequents is in danger of being dried up by the summer-heat, the leech buries itself in the mud at a considerable depth. Just before a thunder-storm, the leeches appear much agitated, and rise frequently to the surface of the water ; this therefore is considered by the *leech-gatherers* as a favourable time for collecting them.

This property by which a leech anticipates thunder, has induced some persons to employ them as a species of barometer ; for this purpose a leech is enclosed in a glass vessel half filled with water, and the following is supposed to be the result. When the weather is about to be serene and pleasant, the leech will remain at the bottom of the vessel without the least movement ; secondly, if it is about to rain, the animal will rise to the surface, and there remain until the approach of fine weather ; thirdly, that before boisterous weather, it will appear in a state of great agitation ; fourthly, on the approach of thunder, it will remain out of water for several days, appearing agitated and restless, and so on.

This natural barometer appears to answer tolerably well, if there is sufficient belief in its virtues on the part of the possessor, and if one leech only is employed ; but when several of these creatures are enclosed in the same vessel, they do not appear to obey the same laws, and, consequently, their movements do not correspond with sufficient accuracy to render their indications of the weather of much use.

The medicinal leech appears during its whole life to

exist on the blood or other juices of the creatures on whose body it fixes itself; this is not the case with the horse-leech, which lives entirely on the *larvæ* of aquatic insects, worms, &c., so that the common idea of the danger of the bite of the horse-leech is without foundation.

The Horse-leech is exceedingly voracious, not only swallowing worms, tadpoles, &c., but even preying upon its own species. Sixty-five horse-leeches were placed in a glass vessel, and in five days the number was reduced to fifty-two, and not a vestige of those that were missing was to be discovered.

The usual slowness of action of the digestive powers in all animals of cold blood, was curiously illustrated in the case of a horse-leech, which, after swallowing two small leeches of a different species, disgorged one of the two at the end of three days, in a living state, and apparently not much injured from its sojourn in so unusual a lodging; but it enjoyed its liberty only for a few hours, its more powerful companion swallowing it a second time at the end of that period.

A number of this species of leech, inhabiting the water that supplied a trough in which a tench had been placed, fixed themselves to different parts of the body of the fish, and so effectually was the poor tench annoyed, that it was soon deprived of life. "The leeches then tore it (previously breaking the line of connexion between the various parts of the body, by inflicting a vast number of bites or wounds,) into such pieces as they could readily receive into the stomach, and so diligent were they, that in a few days nothing remained of the fish but the mere skeleton.

From these habits it would appear that the name of

Hirudo sanguisuga (the blood-sucking leech,) has been improperly applied to the horse-leech; on this account a recent author has suggested the name of *Hirudo vorax*, (the voracious leech,) as being more suitable to its nature.

Leeches are supposed to be very long-lived; two were preserved, in confinement, for eight years before they died, and the well-ascertained slowness of their growth seems to place their length of life beyond a doubt.

On the head of the medicinal leech ten points are arranged in the form of a horse-shoe, thus—
 These are considered by some authors, to be
 organs of sight, or eyes, while, on the other
 hand, it is stated by others, that they are merely
 tubercles. Lamarck was of this opinion, and consequently, in describing their character, says they are without eyes.

The teeth, or rather piercers, with which the leech is furnished, are three in number, of a hard gristly substance, and so placed with regard to each other as to meet in the centre at equal angles: these piercers are thrust into the skin when the animal attaches itself; not by one plunging effort, but by constantly scratching or sawing upon the surface, (assisted at the same time by the sucking action of the lips,) in this manner they gradually become buried in the skin, and there remain as long as the creature retains its hold; this movement of the piercers occasions the gnawing pain felt for the first two or three minutes after the leech has commenced operation.

Leeches are at times so scarce and valuable, that great care has been taken in preserving them in a healthy state and fit for use. The principle of their

management consists in placing them in vessels sufficiently large, keeping the water clear, and in removing those which are unhealthy as soon as they are discovered.

Leeches, when applied to the skin, frequently show little inclination to bite, and many plans have been resorted to, to induce them to commence operations, such as bathing the part with milk, &c.; but these methods may be considered useless, and the best method appears to be, to wash the part clean, and this is the more necessary when any embrocation has been previously applied; but the surest plan is to puncture the place slightly, so as to cause the blood to appear. If the little surgeon, before it is fully gorged, appears lazy and unwilling to proceed, it can be usually roused by being sprinkled with a little cold water.

After a leech has fallen off, it is usual to sprinkle salt on it to induce it to disgorge the blood it has swallowed; but as the salt frequently blisters its body, it has been recommended by Dr. Johnson of Edinburgh, from whose work on the leech we have obtained most of the preceding information, to apply a small portion of vinegar to the head of the leech instead of salt.

The necessity for obliging the leech to dislodge the blood it has swallowed, arises from the fact that it would remain in the body of the animal for some months before it could be all digested; but the most singular thing is, that during the whole of this time, the blood remains in nearly as fluid a state as when it was newly swallowed*.

* It has been quaintly said on the subject of depriving the leech of its food, that "Those persons do not consider that blood is the most favourite and salutary nourishment of this extraordinary creature, and I would ask such inconsiderate persons how they would feel themselves, if, immediately after eating a hearty dinner, any person was to give them a violent emetic."

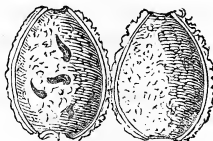
The stomach of this creature is very curiously formed, being composed of a number of chambers, each chamber having a separate connexion with the intestinal canal, in such a manner that, at the will of the animal, the contents of each chamber can be emptied singly into the intestinal canal, through a distinct opening.

It was long a matter of dispute as to whether leeches were produced from eggs or born alive, but it is now ascertained that they are developed in a singular case, having some resemblance to the cocoon of a silk-worm. The following engraving represents this case, of its natural size: fig. 1 shows the perfect case or cocoon, and fig. 2. the same opened, with the young leeches con-

Fig. 1.



Fig. 2.



tained within it; it is said that, at times, there are as many as thirteen or fourteen in one case. This cocoon is formed by the parent animal, and by it deposited in the mud or clay which composes the bed of the pool it inhabits.

The fact of the young leech being produced from these cocoons, although only latterly ascertained by naturalists, appears to have been well known to the dealers in leeches on the French coast, who availed themselves of this knowledge of their habits, to multiply them for the purpose of sale.

“It was by these means the leech-dealers of Bretagne,

and particularly in Finisterre, replenished the ponds in which they preserved those leeches which were intended for the Paris market.

“ About the month of April or May, according to the nature of the season, they send out labourers, provided with spades and baskets, to the little muddy marshes, where they are known to exist in abundance. These workmen then set about removing those portions of mud that are known to contain cocoons, which are afterwards deposited in sheets of water previously prepared for their reception, here the young leeches quit the cocoons and are allowed to remain for six months, when they are removed to larger ponds.” While they remain in these ponds, the cattle and other animals are driven to the water, for the purpose of allowing the young to feed upon them, as it is supposed that they grow much more rapidly after having partaken of blood.

There is a small species of leech in the island of Ceylon, which is more dreaded, and, from its great numbers, produces more evil than even the venomous reptiles which are found in the island, including the terrible hooded snake itself.

The largest of these leeches are seldom more than half an inch in length, and the smallest are minute indeed. This leech is a very active animal; it moves with great rapidity, and is even said occasionally to spring. It is supposed to have an acute sense of smelling, for no sooner does a person stop where leeches abound, than they appear to crowd eagerly to the spot from all quarters. In rainy weather, it is shocking to see the legs of men on a long march, thickly beset with these creatures, gorged with blood, and the blood itself trickling down in streams. It might be supposed there

would be little difficulty in keeping them off; but they crowd to the attack, and fasten on more quickly than they can be removed. Their bites are much more troublesome than would be imagined, being very apt to fester and become sores, and in persons of a bad habit of body, to degenerate into extensive ulcers, and ultimately cause the loss of a limb, if not that of life itself.

Many plans have, of course, been resorted to, to avoid this pest, such as anointing the legs with tobacco-water, grease, &c., but all to very little purpose, the only successful plan appearing to be, the enclosing the lower part of the legs in boots and pantaloons, fitting very closely to the limb, a very unpleasant dress in so sultry a climate.

CLASS CRUSTACEA.

THE arrangement of the Crustacea in systems of natural history has undergone numerous changes; they were placed by Linnæus among the insects;—others considered them to have more analogy to the spiders. Lamarck was the first who made the Crustacea an independent CLASS forming two *orders*, which he has named after the arrangement of the branchiæ, or gills, by which they breathe, namely, the *Crustacea homobranchiæ*, the distinguishing marks of which he describes in this manner. Branchiæ hidden under the lateral margins of a kind of cuirass, covering the body of the animal, with the exception of the tail. The mandibles always furnished with feelers, the eyes placed on footstalks, the head not distinct from the trunk, and possessing ten feet to assist them in their movements. Secondly, the *Crustacea heterobranchiæ*, in which the branchiæ are external, in various situations, but never under the lateral margin of a cuirass; they are either under the belly or the tail, adhering to the feet or confounded with them; the eyes are in general fixed, *sedentary, not on foot-stalks*.

ORDER CRUSTACEA HOMOBRANCHIÆ. (*Shell-Fish with concealed gills.*)

THE first of these orders, the *homobranchial* crustacea, includes most of the larger kinds of shell-fish, as, for instance, crabs, lobsters, and cray-fish; shrimps and prawns are also in this division.

Their organization is much more perfect than that of the other order, and, according to Lamarck, it is among these animals that the last appearance of the organ of

hearing is seen, in tracing the animal kingdom, from the most perfect animals to those whose formation is apparently less complex.

The body of these creatures appears to be composed of only two principal parts, the body and the tail; for the head is so intimately united and confounded with the trunk, as to appear to be merely a portion of it. The two eyes are fixed at the top of two moveable supports, and are inserted in a hollow, prepared for their reception on each side of a projecting portion of the shell that covers the head. The antennæ, which are usually four in number, are placed about this spot; they are inserted beneath the stems that support the eyes. The two outermost of these antennæ are generally the longest.

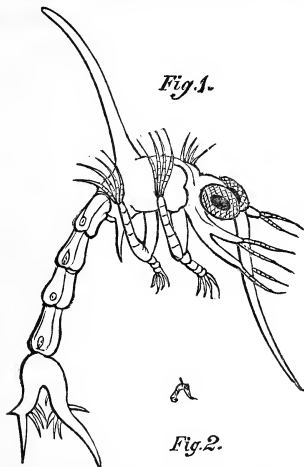
The branchiæ, or organs by which they breathe, assume a form somewhat pyramidical, arranged like a series of leaves, or the web of a feather; they are placed in the interior of the shell along each side, and are so arranged as to adhere to the roots of the feet, so that each of these feet has a hidden branchia attached to its base.

The mouth is composed of a fleshy lip, projecting between the mandibles; of two hard triangular mandibles, more or less notched at their extremity, and each having a kind of feeler inserted on the upper part; they also possess a little tongue between these mandibles, at the root of which is the opening to the stomach: they have besides two pair of jaws like leaves, the borders of which are fringed, and six other members, which Lamarck calls *foot-jaws*, from their bearing some resemblance to legs, or feet. From this it appears that the parts of the mouth in Crustacea form a complicated apparatus, and accordingly we find the whole tribe exceedingly voracious, the crabs in particular, feeding

upon any animal substance, putrid or not, that may come within their reach. Some of the species are well known as articles of food, but they are not equally wholesome at all seasons of the year.

THE CRAB TRIBE.

THE genera of the Crustacea are so extremely numerous, and the knowledge we possess of their natural history is so scanty, being generally confined to their form and colour, that we shall limit ourselves to a description of some of the best known and most useful species.



THE ZOEÆ OF THE COMMON CRAB.

The Crabs are a very numerous tribe, and contain many singular species, as far as regards their form, which

assumes an endless variety of curious shapes, sometimes elegantly decorated with the most brilliant colours; this more particularly applies to those which are found in the seas of hot climates.

The singular little animal represented in the preceding page, was placed by naturalists among the *crustacea*, and considered a perfect animal of a distinct species; it was named Zoea. Mr. Thompson, the experienced naturalist we have already noticed, was the first to discover the real nature of this little creature. We cannot do better than to introduce the subject by the following observations of the author of this discovery, showing the reason so little is known respecting these inhabitants of the deep.

“The sea (which is the habitation of the greater part of the *crustacea*) to the casual observer offers nothing but an immense body of water, here and there presenting a solitary whale, or a vagrant troop of some of the smaller cetaceous animals; the appearance of a fish of almost any other kind in the track of a vessel over a vast expanse of the open ocean, is regarded, even by the mariner, as a kind of phenomenon, and creates an interest not to be appreciated by those who have not engaged in distant voyages. The fathomless parts of the ocean certainly do not offer the same profusion of inhabitants with the shores of islands and continents, or those parts where the bottom is within reach of the sounding-line, or where the surface is interspersed with fields of Sargosa*. On due examination, however, we shall not fail to find it everywhere peopled by a considerable variety of animals, either of small size, or possessed of such a degree of translucency, as to render them invisible, or scarcely perceptible, even when on or near to its surface; that it should possess its share of the organized

* A kind of sea-weed, (*Fucus natans*.)

beings which we see spread over every other part of the surface of our globe, is a conclusion we might arrive at indirectly, from the consideration of oceanic fishes and birds being observed in those parts of the ocean most distant from the land, and the provident care of the Deity, which we invariably witness throughout the domain of nature, to furnish food for all, even the meanest of his creatures; the more minute and invisible inmates of the sea then must constitute the food of oceanic fishes and birds.

Few of these marine animals, except some of the larger and most conspicuous, have as yet been observed, so that the investigation of them holds out a promise of a rich harvest to the naturalist, and a vast field of exploration, replete with novelty and interest; to accomplish this, however, he must use the greatest diligence, seizing every opportunity, when the way of a ship does not exceed three or four miles per hour, to throw out astern a small towing-net of gauze, bunting, or other tolerably close material, occasionally drawing it up, and turning it inside out into a glass vessel of sea-water, to ascertain what captures have been made. When a ship goes at a greater rate, and in stormy weather, a net of this kind may be appended to the spout of one of the *sea-water* pumps, and examined three or four times a day, or oftener, according to circumstances.

Although naturalists were decided in calling the Zoea a crustaceous animal, they were still far from agreeing as to the place in the system it ought to occupy, for the different species were so unlike each other; but it will be no longer a matter of surprise, when it is known, that this singular creature is not a perfect animal, but merely the larva or imperfect s^t ^{age}

of the common crab. This fact is perfectly new and interesting in a double point of view, not only proving their real nature, but also that the Crustacea are not, as described in most systems, animals undergoing no metamorphosis, and on that account to be separated from the insects, but that they do undergo a metamorphosis, and that of a most wonderful nature.

It was in the Spring of 1822 that Mr. Thompson first met with Zoeæ in the harbour of Cove, and that in considerable abundance; the year following, at the same season, one of considerable size occurred; this was considered a fit object for experiment, and was carefully supplied with fresh sea-water, from May 14th to June 15th, when it died in the act of changing its skin. That portion of its new form which it had been able to disengage was sufficient to show that it bore a great resemblance to the division of the Crustacea in which the crabs and lobsters are placed. This proof, says the author, might be considered incomplete, if I had not had the good fortune to succeed in hatching the *ova* of the common crab during the month of June, which presented exactly the appearance of the *Zoea taurus*.

The Common Crab, *Cancer major*, is so well known, that any description of its appearance would be useless.

The power that is possessed by crabs and lobsters, and other species of Crustacea, to change their shell once in every year, is providentially bestowed upon them, to enable these creatures to increase in size, a thing that would otherwise be utterly impossible, from the peculiar nature of the hard coat in which they are enclosed.

The Crab, in order to prepare for the extraordinary change it is about to undergo, when shifting its shell, chooses a close and well-secured retreat, in the cavities

of rocks, or under great stones, where it creeps in and remains during the operation. The time of the year when this occurs is about the beginning of the Summer, at which time their food is in plenty, and their strength and vigour in the highest perfection. But soon all their activity ceases; they are seen forsaking the open parts of the deep, and seeking some retired situation among the rocks, or some outlet where they may remain in safety from the attacks of their enemies. For some days before their change, the animal discontinues its usual voraciousness; it is no longer seen laboriously harrowing up the sand at the bottom, or fighting with others of its kind, or hunting its prey; it lies torpid and motionless, as if in anxious expectation of the approaching change. Just before casting its shell, it throws itself upon its back, strikes its claws against each other, and every limb seems to tremble; its feelers are agitated, and the whole body is in violent motion; it then swells itself in an unusual manner, and at last the shell is seen beginning to divide at its junctures, particularly it opens at the junctures of the belly, where it was before seemingly united. It also seems turned inside out; and its stomach comes away with its shell. After this, by the same operation, it disengages itself of its claws, which burst at the joints; the animal, with a tremulous motion, casting them off, as a man would kick off a boot that was too big for him.

Thus, in a short time, this wonderful creature finds itself at liberty; but in so weak and enfeebled a state, that it continues for several hours motionless. Indeed, so violent and painful is the operation, that many of them die under it; and those which survive, are in such a weakly condition for some time, that they neither take

food, nor venture from their retreats. Immediately after this change, they have not only the softness, but the timidity of a worm. Every animal of the deep is then a powerful enemy, which they can neither escape nor oppose; and this, in fact, is the time when the dog-fish, the cod, and the ray, devour them by hundreds. But this state of weakness continues for a very short time; the animal, in less than two days, is seen to have the skin that covered its body grown almost as hard as before; its appetite is seen to increase; and strange to behold! the first object, it is said, that tempts its gluttony, is its own stomach, which it was lately disengaged from. This it devours with great eagerness. In about forty-eight hours, in proportion to the animal's health and strength, the new shell is perfectly formed, and as hard as that which was but just thrown aside.

When completely equipped in its new shell, it then appears how much it has grown in the space of a few days; the dimensions of the old shell being compared with those of the new, it will be found the creature has increased in size nearly one-third, and it appears wonderful how the old shell could have contained it.

Many of the cold-blooded animals have the power of reproducing a limb, or a portion of one, if by any accident it has been lost. This faculty of reproduction is possessed by the Crab in great perfection; but it possesses also a surprising power in itself, voluntarily to break off its own legs and claws. It seems this takes place when any serious injury, by bruising, has happened to any of its members. After it has received the hurt it bleeds, and gives signs of pain, by moving the wounded limb from side to side, but afterwards holds it quite still, in a direct and natural position, without touching any

part of its body or its other legs with it. Then, on a sudden, with a gentle crack, the wounded part of the leg drops off at the next joint to the one injured; this appears to be more easily done with respect to the smaller legs, than in the case of an injury occurring to those which bear the pincers.

When the leg has dropped off, a mucus, or jelly, is discharged on the remaining part of the joint next the body, which, as a natural styptic, instantly stops the bleeding; this gradually hardens and grows callous, becoming a new leg in miniature, which at every change of the creature's shell increases rapidly in size.

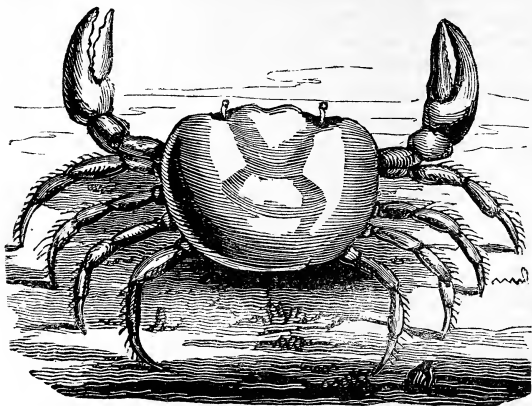
Crabs are naturally very quarrelsome, and with their claws fight and kill each other; and if by chance any of their limbs should be so bruised as to have taken away from the creature the power of breaking off its claws, the protecting jelly is not produced, and the animal bleeds to death. An experiment was made to give some idea of the tenacious disposition of this creature, by obliging a Crab, with one of its great claws, to lay hold of one of its smaller ones; the silly creature did not distinguish that itself was the aggressor, but exerted its strength, and soon cracked the shell of its own small leg, which bled freely; but feeling itself wounded, it succeeded in breaking off its leg in the usual manner,—still, however, holding fast for a length of time the part of the wounded leg which had come away.

The curious shuffling walk of the Crab is well-known, but it does not, as it is said, walk exactly backwards.

THE LAND CRAB.

ALTHOUGH nearly all the Crab tribe are inhabitants of the water, there is a species found in the West Indies

a native of the Bahama Islands, whose habits are unlike those of the rest of its class, and highly curious in themselves.



THE LAND-CRAB, (*Gecarcinus ruricola*.)

Land-crabs do not, like most other crustaceous animals, live near salt water, but take up their abode for the greatest part of the year in holes in the ground, hollow trunks of trees, and other places of the same description, and inhabit the mountainous districts of the islands, many miles from the sea-shore; but although they make these places their usual haunt, it is necessary for them, once a year, to repair to the sea for the purpose of depositing their spawn. They prepare for their annual migration about the month of April or May, and having mustered in immense numbers, the procession sets forward with all the regularity of an army, under the guidance of an experienced commander.

Their destination being the sea, they instinctively move in a direct line to the nearest coast; no obstacle which they can possibly surmount will induce them to turn from their course, for if even a house stands in their way, they endeavour to scale its walls, in which they sometimes succeed; and should a window remain open, they are not unlikely to direct their march over the bed of some heedless sleeper. If, however, a large river crosses their track, they continue to follow its course without attempting to cross it.

It is said, that they are commonly divided into three battalions, of which the first consists of the strongest and boldest males, who, like pioneers, march forward to clear the route. They are often obliged to halt for want of rain, and go into the most convenient encampment till the weather changes. The main body consists of females, who never leave the mountains till the rain has set in for some time; they then descend in regular order, formed into columns of the breadth of fifty paces, and three miles in length, and so close that they almost cover the ground. Three or four days after this, the rear-guard follows, a straggling undisciplined tribe, consisting of males and females, but neither so robust or vigorous as the former parties. The night is their chief time of proceeding. When terrified, they march back in a confused manner, holding up their nippers and clattering them loudly, to intimidate their enemies. Their general food consists of vegetables; but if any of their companions should become maimed, and unable to proceed, they are greedily devoured by the rest.

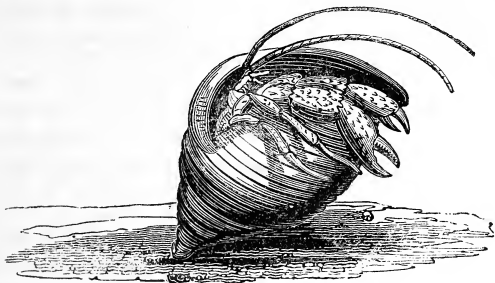
After a march of two, and sometimes three months, in this manner, they arrive at their destined spot on the sea-coast; they immediately enter the water, and after

the waves have washed over them several times, retire to holes in the rocks, and other hiding-places, where they remain until the period of spawning. They then once more seek the water, and shaking off their eggs, leave them to the chance of being hatched, or devoured by tribes of hungry fish, who have already repaired to the spot in countless shoals, in expectation of their annual treat. The eggs that escape are hatched under the sand; and, soon after, millions at a time of the little Crabs are seen quitting the shore, and slowly travelling up to the mountains. The old ones, however, are not so active to return: they have become so feeble and lean, that they can hardly crawl about. Most of them, therefore, are obliged to continue in the flat parts of the country till they recover; making holes in the earth, into which they creep, and cover themselves up with leaves and dirt; here they throw off their old shells, and continue almost without motion for about six days, during which time they become so fat, as to be considered delicious food. In about six weeks, the new shell has become tolerably hard, and the creatures may be seen slowly returning to their mountain-haunts. In some of the sugar-islands, it is said they form no inconsiderable portion of the food of the negroes, who are extremely dexterous in their mode of seizing them, so as to avoid their nippers.

THE HERMIT OR SOLDIER CRAB.

THIS singular species of Crab has obtained its name from its habit of remaining, as it were secluded, in any empty shell, or hole of a rock it may fancy.

The hinder part of its body, particularly the tail, being constantly secure from injury, has its covering reduced to almost a membranous state, while the tail, which assists the other species in swimming, is almost obliterated ; but in those which have chosen a shell for their hermitage, some hook-like appendages are observed, which enable them to maintain a secure hold of their borrowed dwelling. When the body has grown too large for the shell occupied by the animal, it is obliged to seek another of a larger size. The numerous com-



THE HERMIT CRAB, (*Pagurus bernhardus*.)

bats they enter into when seeking a new dwelling, has caused this animal to receive the additional name of the Soldier Crab.

“The Soldier when about to seek a new habitation is still seen (says an amusing writer) in its old shell, which it appears to have considerably outgrown ; for a part of the naked body is seen at the mouth of it, which the habitation is too small to hide. A shell, therefore, is to

be found, large enough to cover the whole body; and yet not so large as to be unmanageable and unwieldy. To answer both these ends is no easy matter, nor the attainment of a slight inquiry. The little soldier is seen busily parading the shore, along that line of pebbles and shells that is formed by the extremest wave; still, however, dragging its old incommodious habitation at its tail, unwilling to part with one shell, even though a troublesome appendage, till it can find another more convenient. It is seen stopping at one shell, turning it and passing it by, going on to another, contemplating that for a while, and then slipping its tail from its old habitation, to try on a new. This also is found to be inconvenient; and it quickly returns to its old shell again. In this manner, it frequently changes, till at last it finds one light, roomy, and commodious: to this it adheres, though the shell be sometimes so large as to hide the body of the animal, claws and all."

Yet it is not till after many trials, and many combats also, that the soldier is thus completely equipped; for there is often a contest between two of them for some well-looking favourite shell, for which they are rivals. They both endeavour to take possession; they strike with their claws; they bite each other, till the weakest is obliged to yield, by giving up the object of dispute. It is then that the victor takes possession, and parades in his new conquest three or four times back and forward, upon the strand, before his envious antagonist.

When this animal is taken, it sends forth a feeble cry, endeavouring to seize the enemy with its nippers; which if it fasten upon, it will sooner die than quit the grasp. The wound is very painful, and not easily cured.

On the English coasts the Hermit Crab is generally

found in the shell of the Whelk, or when of a small size in that of the Periwinkle; they not unfrequently, however, remain in some cranny of a rock, or under the protecting cover formed by a group of pebbles, in the interstices of which they hide themselves.

The ancients were well acquainted with the Soldier-crab, as is evident from the following translation of the lines of one of their poets :

The Soldier-crabs unarm'd by nature, left
Helpless, and weak, grow strong by harmless theft.
Fearful they crawl, and look with panting wish
For the cast crust of some new-covered fish ;
Or such as empty lie, and deck the shore,
Whose first and rightful owners are no more.
They make glad seizure of the vacant room,
And count the borrow'd shell their native home ;
Screw their soft limbs to fit the winding case,
And boldly herd with the crustaceous race.
But when they larger grow than fill the place,
And find themselves hard-pinch'd in scanty space,
Compell'd they quit the roof they loved before,
And busy search around the pebbly shore,
Till a commodious roomy seat be found,
Such as the larger shell-fish living own'd.
Oft cruel wars contending soldiers wage,
And long for the disputed shell engage ;
The strongest here the doubtful prize possess,
Power gives the right, and all the claim possess.

THE LOBSTER, (*Astacus Europæa*.)

THE well-known and delicious shell-fish, the Lobster, is found in great abundance in all the northern parts of Europe. The north of Scotland is famous for the

Lobster, but it is still more plentiful on the coast of Norway. The Crab is more frequently found in shallow water, but the Lobster prefers those spots where the water is of considerable depth. The methods of taking Lobsters are various,—the most usual is by means of what are called Lobster-pots; these are a sort of trap, formed of twigs, and baited with garbage; they are made like a wire mouse-trap, so that when the Lobsters get in there is no possibility of returning. These pots are fastened to a cord, and sunk in the sea, their place being marked by a buoy. Another method of taking them is by means of a kind of bag-net, baited with animal substances. This fishery is only carried on in the night. They are brought in vast quantities to the London market from the Orkneys and from the Norway coast.

Lobsters are much alarmed at the noise of thunder, or any other sudden shock; the consequence of which is, that in their fright, they frequently cast their claws. This also often happens when the poor creatures are thrown into the boiling-pot. As these animals frequent clear water, their habits have been more noticed than those of the Crab. Their mode of feeding is sufficiently curious. In general, the pincers of one of the large claws are furnished with knobs, while the other large claw is more like a saw on its edge; holding, then, its food in the knobbed claw, it dexterously pulls it to pieces with the other; their movements in the water are exceedingly graceful and lively, and they are capable of darting forward to a considerable distance with the rapidity of the flight of a bird. Their colour when in their native element, is not black, as might be imagined, but of a beautiful deep blue.

A whimsical idea of the horror Lobsters are said to have of pigs, seems to have prevailed in some parts of the Continent. It is said, that in Brandenburg, where the fishery is very abundant, the wagoners who transport them by land are obliged to keep watch during the night, to prevent swine from passing the wagon, for if one only was to go by, they say, not a single Lobster would be alive in the morning.

THE RIVER CRAY-FISH, (*Potamobius fluviatilis*.)

THE fresh-water Cray-fish very much resembles the Lobster in appearance, but is considerably broader in its proportions. It is commonly found in the tributary streams of large rivers, inhabiting the banks, in which it burrows, and feeding on any animal substance that may happen to come in its way.

The Cray-fish is taken in various ways, sometimes by the hand, which is thrust into the holes in which they burrow. Another method is thus described:—

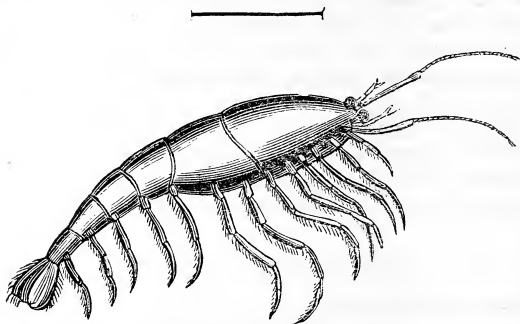
Procure a dozen little rods about five feet in length, and the thickness of the thumb,—split them at the smallest end, and by way of bait, place a frog, or a piece of putrid flesh; take then the rods by their thickest end, and hold the bait at the entrance of the little holes, where you suspect your prey to be; if they are there, they will generally come out to seize the bait. As soon as you perceive them, hold a small landing-net underneath, and raise the bait suddenly, and the Cray-fish will either be brought up along with the bait, or will fall back into the net.

Another method noticed, consists in first burying a

dead cat or a hare in a dunghill, for eight days, and then placing it in the midst of a bush of tangled thorns and brambles, which is thrown into the water, in the place frequented by the Cray-fish. After it has remained there a few hours it may be drawn up, when the shell-fish will be found partaking of their delicate fare, and the tangled bush will effectually prevent their escape.

THE PHOSPHORESCENT SHRIMP.

THE luminous appearance of the ocean at night is a fact well known to all who have been a voyage by sea; and it has been ascertained that the causes of this beautiful



NOCTILUCA BANKSII magnified. The line above shows the natural length.

phenomenon are the phosphorescent properties which are possessed by many of the smaller inhabitants of the deep. Among these, the little animal figured above is very frequently met with.

The author we have lately quoted, says,—

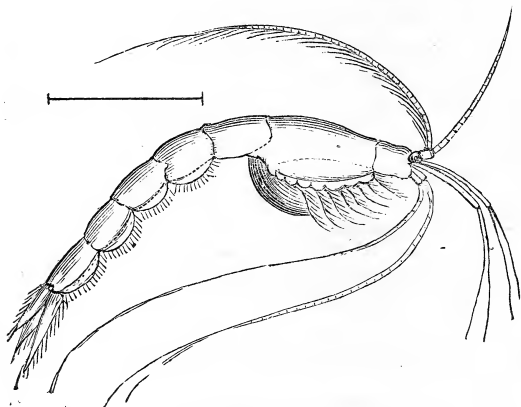
“Meditating upon this subject, I think it not improbable, that the Deity, who has done nothing in vain, and whose omniscience extends to every epoch, foreseeing that man would invent the means of tempting the trackless ocean, and explore the most distant regions of our planet, has given it as one means of rendering his nights less gloomy, and of diminishing the number of his dangers; especially if we consider that this luminosity is seen only in the night-season,—is vivid in proportion to the darkness, disappearing even before the feeble light of the moon,—and also that it increases with the agitation of the sea, so that during the prevalence of storms it greatly diminishes the dense gloom which at such times is often impenetrable to the moon and the stars, throws such a light upon the ship and rigging as to enable sailors to execute their allotted tasks with certainty, and at all times points out to the cautious mariner the lurking danger of sunken rocks, shoals, and unknown coasts, by the phosphorescent, or snowy appearance which it gives to the breakers, so as to render them visible at a considerable distance.

THE OPOSSUM SHRIMP.

THIS small species of Shrimp, although it has much the same outward appearance as the Common Shrimp, except that it is considerably smaller, is, when duly examined, one of the most singularly-formed creatures of the class to which it belongs. It is found in tolerable abundance along the British coasts, but the northern seas literally swarm with them; there, in spite of their small size, they are destined to become the food of the

stupendous whale, whose enormous mouth encloses myriads at a time.

The Opossum Shrimp belongs to a group of crustaceous animals which have been called fissipeds, (*split-feet*), on account of each of their feet being divided nearly throughout its whole length; the inner limb being constructed for progression and the seizing of their prey, and the outer for swimming and giving that motion to the water which is essential to the organs of



THE OPOSSUM SHRIMP.

breathing, which are, as it were, wrapped round the base of each limb, and fully exposed to the action of the element. In the other crustacea, which they most nearly approach, such as Shrimps, Prawns, &c., there is a single row of five feet on each side; but the genus we are now describing possesses as many as four rows of

feet, each containing eight, so that in all, the number of feet amounts to as many as thirty-two,—sixteen adapted for swimming, and sixteen for seizing their prey. In consequence of this organization, the Shrimps seek their food in the sands at the bottom, while the present genus frequent the surface.

The most singular portion of their formation, and that to which they are indebted for a name, is a kind of pouch which the female possesses, fixed beneath the body, and formed of two concave pieces of shell; this pouch, which is very capacious, considering the size of the animal, is destined to receive the eggs, which are deposited in it, enveloped in a kind of jelly-like substance, most probably forming the food of the young when first hatched. As fast as the young assume the lengthened form of the perfect animals, they are found to arrange themselves in this pouch closely and regularly side by side, with their heads towards the breast of the mother. After this manner they lie closely compacted together, and present a perfectly symmetrical arrangement, easily observed from the translucency of the valves of the pouch, and the large size and blackness of their eyes. The males of the Opossum Shrimp are not so numerous as the females, and are without the singular pouch we have described.

We have already noticed the fact of these Shrimps being the food of the Greenland whale, in the northern seas, but in these climates they serve as food for herrings.

It is in looking closely into the structure of these little animals that we see the perfection of the Divine Artist. Nature's greater productions appear coarse indeed to these elaborate and highly-finished master-pieces, and

in using more and more powerful magnifiers we still continue to bring new parts and touches into view. If, for instance, after observing one of their members with the naked eye, which has informed us that the part we have been examining is composed but of one piece, we employ a magnifying-glass with a low power, the same part appears jointed, or composed of several pieces articulated together. Employing a higher magnifier, it appears fringed with long hairs, which, on further scrutiny, seem to be themselves fringed with hairs still more minute; many of these minute parts also, are evidently jointed, and perform sensible motions. But what idea can we form of the various muscles which put these parts in movement, of the nerves which actuate them, and the vessels which supply them with the nourishment necessary for growth and support, and which we know, from comparison with other creatures, they must possess!

The Opossum Shrimps, we have seen, are the prey of the larger inhabitants of the deep; but they, in their turn, destroy others that are smaller than themselves,—seizing upon every animal substance they are able to manage that comes within their reach, and, if placed in a vessel of sea-water by themselves, devouring each other.

The species represented in the engraving has been called the *Mysis chamæleon*, from its colour varying according to the substances on which it feeds, through all the gradations of gray, black, brown, and pink.

ORDER CRUSTACEA HETEROBRANCHIÆ.

(Crustacea with Organs of Breathing variously placed, never concealed.)

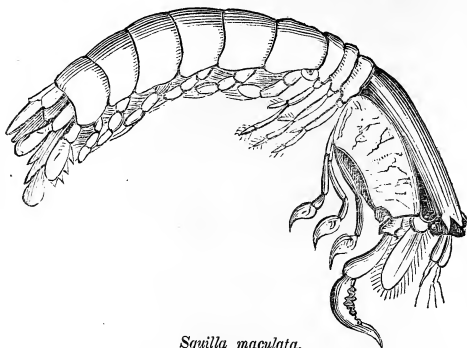
THE crustacea which form this order differ much more from each other than those which are arranged in the last order, and consequently we find among them some very singular in their outward formation. Few of the species appear to be used as food by mankind, but they constitute a great portion of the nourishment of fishes and other inhabitants of the water. They are at times used by fishermen as bait; many of them are very minute, and form most excellent objects for the microscope. They have been divided into several sections according to their outward form; but as so little is known of their habits, we shall confine ourselves to a description of some of the best known.

THE SPOTTED SQUILL.

THE Squill seems to form a connecting link between the last and present order. It is the only genus of the heterobranchial crustacea in which the eyes are placed on footstalks, the head, instead of being distinct, appears in a great measure drawn into the corslet. It has been called the sea mantis, from its bearing some resemblance to an insect of that name, on account of the singularly-formed hooks with which two of its foot-jaws are armed.

The species shown in the engraving is found in the Indian seas; it is the largest of the genus.

The shell with which these creatures are covered has very little consistence, more resembling hardened skin than shell ; they frequent the sandy bottoms of the sea.



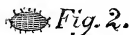
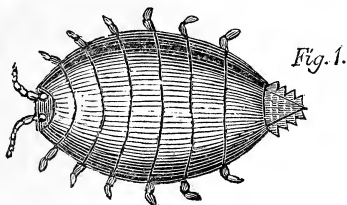
Squilla maculata.

There is a small species which is found in fresh water in which the young, after the eggs are hatched, remain for some time in shelter under the plates with which the body of the mother is covered.

THE COMMON CLOPORTUS.

THIS animal is very common upon old walls and under stones. It is somewhat like the wood-louse, but more flat ; it is essentially a dweller on the land, but it cannot exist except in damp places, where the moisture is sufficient to keep its branchiæ pliable ; it belongs to a group of small crustacea known by the name *oniscus*. Some, as we see in the present instance, frequenting the land, but the greater portion inhabiting the water.

Among those which inhabit the water, there is a minute species which is in the habit of destroying timber under water. The temporary wood-work used during the time the Bell-Rock Lighthouse was in the course of erection, was destroyed, to a great extent, by this little creature, although the wood had not been under water for more



Cloportus ascellus. (Fig. 1. much magnified ; fig. 2, natural size.)

than twelve months. Another species, *cymothoa*, attaches itself to the backs of different species of fishes, living upon the juices of their body.

A crustaceous animal nearly allied to this last is described in the fifth volume of the *American Philosophical Transactions*; it is accompanied by an engraving, but not drawn with sufficient accuracy to be referrible to any particular species; by this account it appears that, instead of attaching itself to the body of the fish, the parasite makes safe its lodgement on the roof of the mouth. The author thus describes it :

“Among the fish that at this early season of the year (February) resort to the waters of York River, in Virginia, the Alewife, or Oldwife, called also the bay Alewife, arrives in very considerable shoals, and in some

seasons their number is almost incredible. They are fully of the size of a large herring, and are principally distinguished from the herring by a bay, or red spot above the gill-fin. They are, when caught from March to May, full roed and fat, and at least as good a fish for the table as the herring.

"In this season, each of these Alewives carries in her mouth an insect about two inches long, hanging with its back downwards, and firmly holding itself by its fourteen legs to the palate.

"I have sometimes succeeded in taking out the insect in a brisk and lively state. As soon as he was set free from my grasp, he immediately scrambled nimbly back into the mouth of the fish and resumed his position. In every instance he was disgustingly corpulent and unpleasant to handle, and it seemed that, whether he had obtained his post by force or favour; whether he be a traveller or constant resident, or what else may be his business where he is found, he certainly fares sumptuously every day.

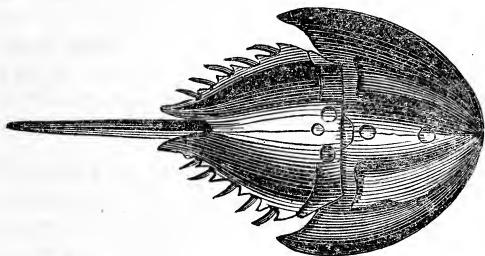
"The fish whose mouth he inhabits, comes about the same time with the Shad into the rivers of Virginia from the ocean, and continues to travel upwards from the beginning of March to the middle of May. As long as they are caught on their passage up the river they are found fat and full of roe. Every fish which I saw had the *Oniscus* in his mouth, and I was assured, not only by the more ignorant fishermen, but by a very intelligent man who came down now and then to divert himself with fishing, that in forty years' observation he had never seen a bay Alewife without the louse.

"The *Oniscus* itself, as the author states, is not without its enemies, many of these he caught with two or

three leeches attached to their body, and adhering so closely that their removal cost them their heads."

THE MOLUCCA CRAB.

WHY the singular creature here represented should have the name Polyphemus given to it, is hard to guess. Polyphemus, as every school-boy knows, was the fabled giant overcome by Ulysses, who is represented as having one eye in the centre of his forehead; whereas, this creature has two eyes and one horn. It is interesting from its being so nearly allied to many very minute species.



Polyphemus gigas.

The Polyphemus sometimes reaches the length of two feet; there are but two species, which only differ from each other in the shape of their buckler. That we have represented is found in the Indian Ocean, and has been called the Molucca Crab.

The tail, or rather the horn, of the Polyphemus, is greatly dreaded by the fishermen, from the idea that its

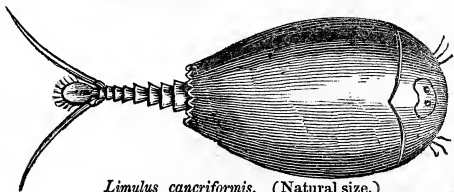
wound is venomous. The natives employ it to point their arrows, and as they are in the habit of poisoning the points of these weapons, it is most likely from this circumstance that the idea we have noticed originated, for there is no other ground for the belief.

During the night-time they lie half out of the water, and are then very easily taken, as they appear to take but little notice of anything until their danger becomes imminent.

It is but a small portion of their flesh that is considered good for food, but the eggs, which are very numerous, are reckoned a delicacy.

These Crabs are in the habit of leaving the water and walking to a considerable distance over the wet sands,—but if incommoded by the sun, they hurry back as fast as they are able to their native element. When walking, none of its legs are visible. Most authors say that, if this Crab is laid on its back, it must inevitably perish, unless the waters return in time, but one observer asserts that it has the power of righting itself with the assistance of its tail.

THE CRAB-LIKE LIMULUS.



Limulus cancriformis. (Natural size.)

THE Limuli are found in deep ditches of fresh water, marshes, &c.; they are frequently met with congregated

together in great numbers; their principal food in the Spring appears to be tad-poles.

This genus, says Lamarck, is almost isolated among the group in which it is placed. Its body is covered with a great horny buckler, very thin, and made of a single piece, of a roundish oval form. The head is confounded with the trunk, and the antennæ are very short. They possess three eyes, two in front, and one, very small, further back. Their legs are very numerous,—the two in front, much the largest, spread out in the form of oars, and furnished at their extremity with silky articulated bristles.

THE WATER FLEA, (*Cyclops quadricornis*.)

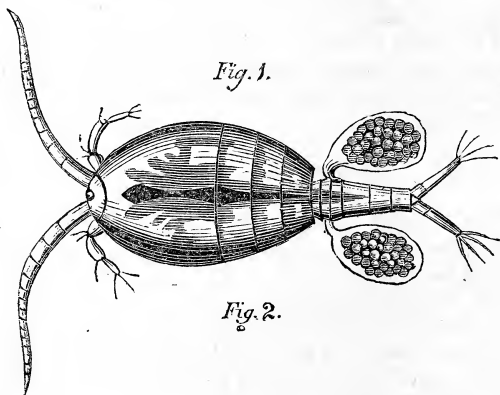
THERE are as many as twelve known species of the Water Flea. That represented in the engraving is extremely common, and forms a most interesting object for the microscope. We have availed ourselves of Mr. Pritchard's popular description of this curious creature.

The Author of Nature, to whom all things are alike easy of execution, as if intending to teach man a lesson of humility, and that no part of creation, however minute, is beneath his consideration, has conferred on these animals, that are barely perceptible to our unassisted vision, more elegance and variety of form, more richness in their colouring, and more beauty and exquisite finishing, than on the whale or the elephant, which mainly excite our admiration, by the magnitude of the mass of living matter they present to us.

These little crustaceous animals may be found at all seasons of the year, near the surface of the water; they are, however, most abundant in July and August. I

have collected great numbers of them on a warm day in the latter month, with a small cloth net, immersing it about an inch below the surface. They are mostly colourless in ponds covered with herbage, but in small collections of rain-water, on a loamy soil, are of a fine rich colour.

The body of this creature is covered with crustaceous or shelly plates, which overlap each other, and admit both of a lateral and vertical motion between them. Their ends do not meet on the side, but have sufficient space between them for the insertion and play of the organs of respiration. The rostrum, or beak, is



Cyclops quadricornis. (Fig. 1, highly magnified ; fig. 2, natural size.)

short and pointed ; it is a prolongation of the first segment which forms the head. A little above the beak, a single eye is embedded beneath the shell, of a dark

crimson colour, nearly approaching to blackness. The true form of this organ it is difficult to determine. Mr. Baker gives it the shape of two kidney-beans placed parallel to each other, and united at their lower extremities. When viewed laterally, it appears round, while in some other positions it is square."

The eggs are curiously placed in two bags, presenting an appearance similar to clusters of grapes, and of considerable magnitude compared with the size of the animal. These egg-bags are seen in the engraving (which represents a female), projecting from each side of the hinder portion of the shell. The centre of each egg is of a deep opaque colour, which in some specimens is green, in others red.

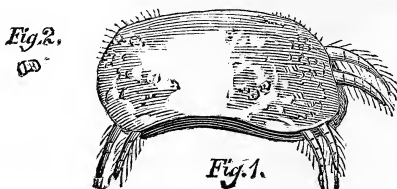
The young of the Cyclops when first excluded from the egg are extremely minute, and so different from the mother, that Müller has described them as forming two distinct genera.

THE HAIRY CYPRIS.

THESE singular little creatures are found in stagnant fresh water; they are very small, and, at first sight, appear like a bivalve shell. The animal which is enclosed in this two-valved case, opens and shuts it at will; when it does this it throws out from one end of the shell numerous whitish hair-like members; it is by moving these that it is enabled to swim with considerable celerity, and it never stops until it meets with some object on which it can rest. Its two antennæ, which issue from the fore part of the shell, are long, very flexible, and bent backwards; their articulations are numerous, which renders them very flexible. The movements of these antennæ

contribute materially to the swimming powers of the creature.

At the place where the head is united to the body, a small black point is seen,—this is the eye of the animal.



Cypris pubera. (Fig. 1, highly magnified; fig. 2, natural size.)

The Cypris changes its shell like the rest of the crustacea; it is found in marshes where vegetable substances are growing. Sometimes they are so numerous, that the water appears covered with them; they are more usually found in Spring and Autumn than at any other part of the year; from this it is inferred that there are two broods in the course of the year.

The drying up of marshes during the Summer heats, destroys immense numbers every season. It appears, however, from observation, that in this case, some of these tiny creatures manage to bury themselves in the mud, where they hermetically close their shells, and remain in a kind of dormant state until rain or other causes have again filled the marshes with water.

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